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UNITED STATES NATIONAL MUSEUM

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## ADVERTISEMENT

The scientific publications of the National Museum include two series, known, respectively, as *Proceedings* and *Bulletin*.

The *Proceedings* series, begun in 1878, is intended primarily as a medium for the publication of original papers, based on the collections of the National Museum, that set forth newly acquired facts in biology, anthropology, and geology, with descriptions of new forms and revisions of limited groups. Copies of each paper, in pamphlet form, are distributed as published to libraries and scientific organizations and to specialists and others interested in the different subjects. The dates at which these separate papers are published are recorded in the table of contents of each of the volumes.

The present volume is the seventy-ninth of this series.

The series of *Bulletins*, the first of which was issued in 1875, consists of a series of separate publications comprising monographs of large zoological groups and other general systematic treatises (occasionally in several volumes), faunal works, reports of expeditions, catalogues of type specimens and special collections, and other material of similar nature. The majority of the volumes are octavo in size, but a quarto size has been adopted in a few instances in which large plates were regarded as indispensable. In the *Bulletin* series appear volumes under the heading *Contributions from the United States National Herbarium*, in octavo form, published by the National Museum since 1902, which contain papers relating to the botanical collections of the Museum.

ALEXANDER WETMORE,  
*Assistant Secretary, Smithsonian Institution.*

WASHINGTON, D. C., *June 25, 1932.*





# CONTENTS

	Article
BALDUF, W. V. Revision of the chalcid flies of the tribe Decatomini (Eurytomidae) in America north of Mexico. No. 2894, pp. 1-95. May 19, 1932 <sup>1</sup> .....	28
New species: <i>Decatoma vacciniicola</i> , <i>D. texana</i> , <i>D. disholcaspidis</i> , <i>D. mimosae</i> , <i>D. lobatae</i> , <i>D. globuli</i> , <i>D. novascotiae</i> , <i>D. flavipes</i> , <i>D. brevilobae</i> , <i>D. occidentalis</i> , <i>D. pezomachoides</i> , <i>D. pomiformis</i> , <i>D. quinquesepiae</i> , <i>D. wiltzae</i> .	
New varieties: <i>Decatoma dubia rufosa</i> , <i>D. occidentalis flavifrons</i> , <i>D. foliatae arizonica</i> .	
BARTSCH, PAUL. A new shipworm from Venezuela. No. 2874, pp. 1-3. April 7, 1931 <sup>1</sup> .....	8
New species: <i>Teredo</i> ( <i>Neoteredo</i> ) <i>healdi</i> .	
———. A new pearl oyster from the Hawaiian Islands. No. 2878, pp. 1, 2. June 2, 1931 <sup>1</sup> .....	12
New species: <i>Pinctada galtsoffi</i> .	
———. Descriptions of new marine mollusks from Panama, with a figure of the genotype of <i>Engina</i> . No. 2881, pp. 1-10. August 1, 1931 <sup>1</sup> .....	15
New genus: <i>Eudaphne</i> .	
New species: <i>Anachis tabogaensis</i> , <i>A. dalli</i> , <i>Eudaphne allemani</i> , <i>Mitra</i> ( <i>Scabricola</i> ) <i>marshalli</i> , <i>Rissoina allemani</i> , <i>Engina panamensis</i> , <i>E. tabogaensis</i> .	
BLAKE, DORIS HOLMES. Revision of the species of beetles of the genus <i>Trirhabda</i> north of Mexico. No. 2868, pp. 1-36. July 24, 1931 <sup>1</sup> .....	2
New genus: <i>Derospidea</i> .	
New species: <i>Trirhabda adela</i> , <i>T. borealis</i> , <i>T. neoscotiae</i> , <i>T. viridicyanea</i> , <i>T. pilosa</i> , <i>T. confusa</i> , <i>T. sericotrachyla</i> .	
New variety: <i>Trirhabda borealis indigoptera</i> .	
COLLINS, HENRY B., JR. Excavations at a prehistoric Indian village site in Mississippi. No. 2898, pp. 1-22. February 25, 1931 <sup>1</sup> .....	32

<sup>1</sup> Date of publication.

- CUSHMAN, R. A. Descriptions of thirteen new American and Asiatic ichneumon-flies, with taxonomic notes. No. 2880, pp. 1-16. August 1, 1931<sup>1</sup>----- 14
- New species: *Ectopimorpha luperinae*, *Photocryptus ater*, *Calliephialtes nucicola*, *C. benefactor*, *Eiphosoma paraguayense*, *E. batatae*, *Helconidea necydalidis*, *Chelonus* (*Chelonella*) *pectinophorae*, *Fornicia pilosa*, *Vipio chinensis*, *Atanycolus anocomidis*, *Microbracon nigrorufum*, *M. isomera*.
- New combination: *Photocryptus pachymenae* (Cresson).
- DIKMANS, G. Two new species of nematode worms of the genus *Ostertagia* from the Virginia deer, with a note on *Ostertagia lyrata*. No. 2872, pp. 1-6. July 25, 1931<sup>1</sup>----- 6
- New species: *Ostertagia odocoilei*, *O. mossi*.
- Two new lungworms from North American ruminants and a note on the lungworms of sheep in the United States. No. 2884, pp. 1-4. August 29, 1931<sup>1</sup>----- 18
- New species: *Protostrongylus stilesi*, *P. macrotis*.
- A new nematode worm, *Viannaia bursobscura*, from the opossum, with a note on other parasites of the opossum. No. 2897, pp. 1-4. November 30, 1931<sup>1</sup>----- 31
- New species: *Viannaia bursobscura*.
- FISHER, ALBERT K., and WETMORE, ALEXANDER. Report on birds recorded by the Pinchot expedition of 1929 to the Caribbean and Pacific. No. 2876, pp. 1-66. August 29, 1931<sup>1</sup>----- 10
- GILMORE, CHARLES W. A new species of troödont dinosaur from the Lance formation of Wyoming. No. 2875, pp. 1-6. June 1, 1931<sup>1</sup>----- 9
- New species: *Troödon wyomingensis*.
- HEINRICH, CARL. Notes on and descriptions of some American moths. No. 2879, pp. 1-16. August 10, 1931<sup>1</sup>----- 13
- New genus: *Tsinilla*.
- New species: *Galenara consimilis*, *Epipyrops cucullata*, *Diatraea considerata*, *Platytes* (?) *aenigmatica*, *Aglossa furva*, *Thiodia implicata*, *Epinotia opposita*, *E. accessa*, *Anchylopera brauni*, *Phaecasiophora inspersa*.
- New variety: *Diatraea busckella rosa*.
- HOUGH, WALTER. The buffalo motive in Middle Celebes decorative design. No. 2895, pp. 1-8. February 11, 1932<sup>1</sup>----- 29

<sup>1</sup> Date of publication.

KRIEGER, HERBERT W. Design areas in Oceania based on specimens in the United States National Museum. No. 2896, pp. 1-53. April 21, 1932 <sup>1</sup> -----	30
LUCKER, JOHN T. A new genus and new species of trematode worms of the family Plagiorchiidae. No. 2885, pp. 1-8. August 29, 1931 <sup>1</sup> -----	19
New genus: <i>Haplometrana</i> .	
New species: <i>Haplometrana intestinalis</i> .	
MACCALLUM, G. A. Four new species of trematode worms of the subfamily Onchocotylineae. No. 2892, pp. 1-8. December 5, 1931 <sup>1</sup> -----	26
New species: <i>Acanthonchocotyle musteli</i> , <i>Squalonchocotyle squali</i> , <i>S. acanthi</i> , <i>S. sphyrynae</i> .	
MALLOCH, JOHN R. Flies of the genus <i>Pseudotephritis</i> Johnson (Diptera: Ortalidae). No. 2900, pp. 1-6. October 21, 1931 <sup>1</sup> -----	34
New subgenus: <i>Pseudotephritina</i> .	
New species: <i>Pseudotephritis</i> ( <i>Pseudotephritina</i> ) <i>inaequalis</i> .	
MANSFIELD, W. C. Some Tertiary mollusks from southern Florida. No. 2887, pp. 1-12. October 9, 1931 <sup>1</sup> -----	21
New species: <i>Olivella tamiamiensis</i> , <i>Mitromorpha gunteri</i> , <i>Turritella pontoni</i> , <i>Cardita</i> ( <i>Carditamera</i> ) <i>tamiamiensis</i> , <i>Cardium</i> ( <i>Trachycardium</i> ) <i>evergladeensis</i> , <i>Parastarte martensi</i> .	
New subspecies: <i>Olivella juspidea gladeensis</i> , <i>Cypraea carolinensis floridana</i> , <i>Turritella cookei gladeensis</i> , <i>Glycymeris lloydsmithi floridana</i> , <i>Venericardia</i> ( <i>Pleuromeris</i> ) <i>perplana gladeensis</i> .	
MARSHALL, WILLIAM B. <i>Anodontites</i> : A genus of South and Central American and Mexican pearly fresh-water mussels. No. 2889, pp. 1-16. October 8, 1931 <sup>1</sup> -----	23
MARTYNOV, A. B. Report on a collection of insects of the order Trichoptera from Siam and China. No. 2891, pp. 1-20. November 5, 1931 <sup>1</sup> -----	25
New genus: <i>Eodinarthrum</i> .	
New species: <i>Rhyacophila sinensis</i> , <i>Glossosoma anale</i> , <i>G. caudatum</i> , <i>Stenopsyche grahami</i> , <i>S. siamensis</i> , <i>Hydropsyche appendicularis</i> , <i>H. penicillata</i> , <i>H. columnata</i> , <i>Hydromanicus intermedius</i> , <i>Pseudostenophylax difficilis</i> , <i>Notopsyche rhombifera</i> , <i>Eodinarthrum pusillum</i> , <i>Goera digitata</i> .	
New subspecies: <i>Pseudostenophylax fumosus</i> Martynov <i>grahami</i> .	

<sup>1</sup> Date of publication.



- MUESEBECK, C. F. W. Descriptions of a new genus and eight new species of ichneumon-flies, with taxonomic notes. No. 2882, pp. 1-16. August 14, 1931<sup>1</sup>----- 16
- New genus: *Paroligoneurus*.  
 New species: *Apanteles paralechia*, *A. depressariae*, *A. schaffneri*, *A. halisidotae*, *A. cingiliae*, *Paroligoneurus johnsoni*, *Microbracon rhyacioniae*, *M. cryptorhynchi*.  
 New names: *Opius gahani*, *O. walkeri*, *Helorimorpha enderleini*.  
 New combinations: *Microgaster fortipes* (Cameron), *Microplitis testaceipes* (Cameron), *Apanteles latiannulatus* (Cameron), *Snellenius philippinensis* (Ashmead), *Opius fuscipennis* (Szepilgeti), *O. fulvus* (Brues), *Rogas macropodides* (Walker), *Yelicones crassitarsis* (Cameron).
- PRICE, EMMETT W. Four new species of trematode worms from the muskrat, *Ondatra zibethica*, with a key to the trematode parasites of the muskrat. No. 2870, pp. 1-13. July 10, 1931<sup>1</sup>----- 4
- New species: *Psilostomum ondatrae*, *Echinochasmus schwartzi*, *Urotrema shillingeri*, *Paramonostomum pseudalveatum*.
- A new species of trematode of the family Heterophyidae, with a note on the genus *Apophallus* and related genera. No. 2883, pp. 1-6. September 21, 1931<sup>1</sup>----- 17
- New species: *Apophallus crami*.
- REINHARD, H. J. The two-winged flies belonging to *Siphosturmia* and allied genera, with descriptions of two new species. No. 2877, pp. 1-11. July 30, 1931<sup>1</sup>----- 11
- New species: *Siphosturmia confusa*, *Siphosturmiopsis melampyga*.
- Revision of the American parasitic flies belonging to the genus *Winthemia*. No. 2886, pp. 1-54. November 24, 1931<sup>1</sup>----- 20
- New species: *Winthemia tibialis*, *W. duplicata*, *W. texana*, *W. polita*, *W. occidentis*, *W. sinuata*, *W. borealis*, *W. intonsa*, *W. cecropiae*, *W. montana*, *W. mima*, *W. singularis*, *W. imitator*, *W. intermedia*, *W. bicolor*, *W. signata*.
- RESSER, CHARLES ELMER. A new Middle Cambrian merostome crustacean. No. 2899, pp. 1-4. December 30, 1931<sup>1</sup>----- 33
- New genus: *Beckwithia*.  
 New species: *Beckwithia typa*, *Obolus johnei*.
- RUEDEMANN, RUDOLF. Some new Middle Cambrian fossils from British Columbia. No. 2893, pp. 1-18. November 27, 1931<sup>1</sup>----- 27
- New genera: *Dictyophycus*, *Marria*.  
 New species: *Dictyophycus gracilis*, *Chaunograptus scandens*, *Marria walcotti*.

<sup>1</sup> Date of publication.

- SHOEMAKER, CLARENCE R. The stegocephalid and ampeliscid amphipod crustaceans of Newfoundland, Nova Scotia, and New Brunswick in the United States National Museum. No. 2888, pp. 1-18. October 16, 1931 <sup>1</sup>----- 22  
 New species: *Haploops spinosa*.
- SKINKER, MARY SCOTT. Three new parasitic nematode worms. No. 2890, pp. 1-9. November 10, 1931 <sup>1</sup>----- 24  
 New genus: *Metathelazia*.  
 New species: *Metabronema canadense*, *Passalurus nonanulatus*, *Metathelazia californica*.
- SMITH, HUGH M. Descriptions of new genera and species of Siamese fishes. No. 2873, pp. 1-48. March 26, 1931 <sup>1</sup>---- 7  
 New genera: *Poropuntius*, *Scaphognathus*, *Gobiella*, *Thaigobiella*, *Pogonogobius*, *Eugnathogobius*, *Pipidonia*, *Herrea*.  
 New species: *Botia beauforti*, *B. horae*, *Laubuca caeruleostigmata*, *Danio kerri*, *D. pulcher*, *Labeo bicolor*, *Cyclocheilichthys tapiensis*, *Puntius wetmorei*, *P. stigmatosomus*, *Poropuntius normani*, *Barilius koratensis*, *B. pulchellus*, *Garra taeniata*, *Epalzeorhynchus siamensis*, *Scaphognathus stejnegeri*, *Mystus havmolleri*, *Pangasius cultratus*, *P. beani*, *P. fowleri*, *P. sanitwongsei*, *Arius sciurus*, *Synaptura aenea*, *Gobiella pellucida*, *Thaigobiella sua*, *Eugnathogobius microps*, *Pipidonia quinquecincta*, *Herrea formosa*, *Creisson sealei*, *Paragobiodon kerri*, *Rhinogobius similis*, *R. atripinnatus*, *Cryptocentrus leonis*, *Apocryptodon malcolmi*.
- TREADWELL, AARON L. Three new species of polychaetous annelids from Chesapeake Bay. No. 2867, pp. 1-5. July 21, 1931 <sup>1</sup>----- 1  
 New species: *Pionosyllis manca*, *Myriana cirrata*, *Prionospio plumosa*.
- WEHR, EVERETT E. A new species of nematode worm from the sage grouse. No. 2869, pp. 1-3. June 24, 1931 <sup>1</sup>----- 3  
 New species: *Habronema urophasiana*.
- . Description of a new genus and species of nematode worm occurring in the northwestern belted kingfisher, with a key to the genera of the subfamily Acuariinae. No. 2871, pp. 1-4. June 20, 1931 <sup>1</sup>----- 5  
 New genus: *Aviculariella*.  
 New species: *Aviculariella alcyona*.
- WETMORE, ALEXANDER. (See FISHER, ALBERT K.)----- 10

<sup>1</sup> Date of publication.

# ILLUSTRATIONS

## PLATES

### REVISION OF THE CHALCID FLIES OF THE TRIBE DECATOMINI (EURYTOMIDAE) IN AMERICA NORTH OF MEXICO

By W. V. Balduf

	Facing page
1-2. Wings of various species of <i>Decatoma</i> .....	94
3-4. Parts of various species of <i>Decatoma</i> .....	94

### A NEW SHIPWORM FROM VENEZUELA

By Paul Bartsch

1. A new shipworm from Venezuela [ <i>Teredo</i> ( <i>Neoteredo</i> ) <i>healdi</i> ].....	1
--	---

### A NEW PEARL OYSTER FROM THE HAWAIIAN ISLANDS

By Paul Bartsch

1. Interior of species of <i>Pinctada</i> .....	2
2. Exterior of species of <i>Pinctada</i> .....	2

### DESCRIPTIONS OF NEW MARINE MOLLUSKS FROM PANAMA, WITH A FIGURE OF THE GENOTYPE OF *ENGINA*

By Paul Bartsch

1. Panama marine mollusks.....	10
--------------------------------	----

### REVISION OF THE SPECIES OF BEETLES OF THE GENUS *TRIRHABDA* NORTH OF MEXICO

By Doris Holmes Blake

1. Species of <i>Trirhabda</i> .....	36
2. Species of <i>Trirhabda</i> , <i>Derospidea</i> , <i>Coraia</i> , and <i>Monocesta</i> .....	36

### EXCAVATIONS AT A PREHISTORIC INDIAN VILLAGE SITE IN MISSISSIPPI

By Henry B. Collins, jr.

1. Vessels from the Deasonville site.....	22
2. Potsherds showing cord-marked exteriors.....	22
3. Potsherds with bold designs in red and white pigment.....	22
4. Potsherds with incised lines at rims.....	22
5. Potsherds showing incised decoration over body of vessel.....	22
6. Potsherds with punctate ornamentation.....	22
7. Examples of handles and lugs on pottery.....	22
8. Awls and scrapers made of antler and bone.....	22
9. Knives, scrapers, and projectile points of stone.....	22
10. <i>a-e</i> , Hammerstones; <i>f</i> , stone celt or ax.....	22
11. <i>a</i> , Pottery pipe; <i>b</i> , pottery object, probably for smoothing pottery; <i>c-e</i> , rounded potsherds for smoothing pottery; <i>f</i> , stone disk, prob- ably for smoothing pottery; <i>g</i> , piece of fire-burned wall clay; <i>h-m</i> , charred corncobs.....	22



	Facing page
12. <i>a</i> , Excavation of House Ring No. 1; <i>b</i> , partially excavated trenches in House Ring No. 1.....	22
13. <i>a</i> , Row of post holes of inner square at center of House Ring No. 1; <i>b</i> , post holes at bottom of trench in House Ring No. 2.....	22

TWO NEW SPECIES OF NEMATODE WORMS OF THE GENUS *OSTERTAGIA* FROM THE VIRGINIA DEER, WITH A NOTE ON *OSTERTAGIA* LYRATA

By G. Dikmans

1. <i>Ostertagia odocoilei</i> .....	6
2. <i>Ostertagia mossi</i> .....	6

TWO NEW LUNGWORMS FROM NORTH AMERICAN RUMINANTS AND A NOTE ON THE LUNGWORMS OF SHEEP IN THE UNITED STATES

By G. Dikmans

1. <i>Protostrongylus stilesi</i> .....	4
2. <i>Protostrongylus macrotis</i> .....	4

A NEW NEMATODE WORM, *VIANNAIA BURSOBSCURA*, FROM THE OPOSSUM, WITH A NOTE ON OTHER PARASITES OF THE OPOSSUM

By G. Dikmans

1. <i>Viannia bursobscura</i> .....	4
2. <i>Viannia bursobscura</i> and <i>Gnathostoma turgidum</i> .....	4

REPORT ON BIRDS RECORDED BY THE PINCHOT EXPEDITION OF 1929 TO THE CARIBBEAN AND PACIFIC

By Albert K. Fisher and Alexander Wetmore

1. Swan Island, Caribbean Sea. Typical scrub on Little Swan Island..	2
2. Coconut grove, Swan Island. Old Providence Island, Caribbean Sea.....	3
3. Cocos Island. Chatham Bay, Cocos Island.....	24
4. The <i>Mary Pinchot</i> at anchor, Barrington Island, Galapagos Group. Settlement at Wreck Bay, Chatham Island, Galapagos Group....	25
5. Seymour Island, Galapagos Group, Daphne Island showing in the distance. Indefatigable Island, Galapagos Group.....	28
6. Man-o'-war bird, Tower Island, Galapagos Group. Galapagos albatrosses, Hood Island.....	29
7. Indefatigable Island, Galapagos Group. Galapagos hawk at nest, Seymour Island.....	36
8. The <i>Mary Pinchot</i> in harbor, Bay of Virgins, Fatuhiva, Marquesas Islands. Fatuhiva Island, Marquesas Islands.....	37
9. Coconut grove, Hivaoa Island, Marquesas Islands. Hivaoa Island, Marquesas Islands.....	56
10. A lowland stream on Hivaoa Island, Marquesas Islands. Toau, Tuamotu Islands.....	57

A NEW SPECIES OF TROÖDONT DINOSAUR FROM THE LANCE FORMATION OF WYOMING

By Charles W. Gilmore

1. <i>Troödon</i> skulls.....	6
2-3. Skull of <i>Troödon wyomingensis</i> .....	6
4-5. <i>Troödon</i> bones.....	6

## NOTES ON AND DESCRIPTIONS OF SOME AMERICAN MOTHS

By Carl Heinrich

	Facing page
1. Structural characters of <i>Galenara</i> .....	16
2. Structural characters of <i>Epipyropidae</i> .....	16
3. Genitalia of <i>Pyalidae</i> .....	16
4. Genitalia of <i>Pyalidae</i> and <i>Olethreutidae</i> .....	16
5-7. Male genitalia of <i>Olethreutidae</i> .....	16

## THE BUFFALO MOTIVE IN MIDDLE CELEBES DECORATIVE DESIGN

By Walter Hough

1. Carved hooks and spoons furnishing key to buffalo designs.....	8
2. <i>a</i> , Bark cloth showing coalescent and integrated units. <i>b</i> , Bark cloth bag with designs demarked in larger units.....	8
3. <i>a</i> , Design doubled, but with only two eye symbols. <i>b</i> , Designs on 4-part bases with many eye symbols.....	8
4. <i>a</i> , Designs of greater prolixity using all elements. <i>b</i> , Wedge-shape design of horns and eyes and geometrical figures.....	8
5. Four-part design surrounded by geometric units.....	8
6. <i>a</i> , Paneled designs surrounded by geometric borders. <i>b</i> , Square design showing motion figure.....	8
7. <i>a</i> , Conventional 4-part design with geometric borders. <i>b</i> , Geometric border bands.....	8
8. Gourd and bamboo containers etched with buffalo designs.....	8
9. Gourd and coconut containers and horn weaving frame.....	8

## DESIGN AREAS IN OCEANIA BASED ON SPECIMENS IN THE UNITED STATES NATIONAL MUSEUM

By Herbert W. Krieger

1. Ethnic areas in Oceania.....	53
2. Marionettes of carved wood. Java.....	53
3. Marionettes of cut leather. Java and Siam.....	53
4. Hawaiian royal feather cape.....	53
5. Woven cloak of the Maori. New Zealand.....	53
6. <i>a</i> , Tapa cloth. Polynesia. <i>b</i> , Tapa cloth. Santa Cruz Islands.....	53
7. Tapa cloth. Samoa.....	53
8-9. Tapa cloth. Fiji Islands.....	53
10. Maori dressing boxes of carved wood. New Zealand.....	53
11. <i>a</i> , Dressing box of the Maori, end view. <i>b</i> , Funnel used in feeding a recently tattooed Maori of New Zealand.....	53
12. Section of a Maori house post.....	53
13. Objects illustrating the wood carver's art of the Marquesans and the Raratongans.....	53
14. Ceremonial adze. Hervey Island.....	53
15. Ceremonial adzes illustrating the Polynesian wood carver's technique. Hervey and the Marquesas Islands.....	53
16. <i>a</i> , A Moro vessel of cast brass from Mindanao, P. I. <i>b</i> , Moro betel nut box of cast brass from Mindanao, P. I.....	53
17. Malay vessel of cast brass and wooden trinket box with shell inlay. Malay teapot of cast brass.....	53

	Facing page
18. Betel nut box of sewn pandanus leaf. Sirah, Middle Celebes. Decorated pommel, handle, and scabbard of Malay steel barongs. Jolo, P. I.-----	53
19. Wooden spoons with carved handles representing "Anitos" or spirits. Ifugas, of Luzon, P. I.-----	53
20. Malay comb of bamboo; tubular containers of bamboo. Luzon, P. I.---	53
21. Decorated bamboo flutes from Middle Celebes-----	53
22. a, Bamboo containers from Dutch New Guinea and the Philippine Islands. b, Decorated bamboo containers. Africa and Middle Celebes.-----	53
23. Exhibit of Fijian decorative and representative art in the United States National Museum-----	53
24. Arts of the Fijians. Pottery and wood carving-----	53
25. Tattooed heads of Maori. New Zealand-----	53
26. Tattoo designs-----	53
27. Decorated heads, Papuans of Territory of Papua, New Guinea-----	53
28. Tubular drum of carved wood. Territory of Papua, New Guinea--	53
29. Conventional ancestral figurine carving showing bird beak and other details on pronged hook used in men's dormitories. Papuans of Territory of Papua, New Guinea-----	53
30. Decorated wooden combs. Papuans of British New Guinea-----	53
31. Tubular wooden drums of the Papuans of the Territory of Papua, Island of New Guinea-----	53
32. Carved wooden figurines representing the conventionalized ancestral spirit with bird beak. Papuans of the Sepik River Territory, British New Guinea-----	53
33. Decorated arrows. Papuans of British New Guinea-----	53

#### A NEW GENUS AND NEW SPECIES OF TREMATODE WORMS OF THE FAMILY PLAGIORCHIIDAE

By John T. Lucker

1. <i>Haplometrana intestinalis</i> , new genus, new species-----	8
---	---

#### FOUR NEW SPECIES OF TREMATODE WORMS OF THE SUBFAMILY ONCHOCOTYLINAE

By G. A. MacCallum

1. <i>Squalonchocotyle</i> and <i>Acanthonchocotyle</i> -----	1
---	---

#### SOME TERTIARY MOLLUSKS FROM SOUTHERN FLORIDA

By W. C. Mansfield

1. Species of <i>Olivella</i> , <i>Cypraea</i> , and <i>Gemma</i> (?)-----	12
2. Species of <i>Turritella</i> and <i>Mitromorpha</i> -----	12
3. Species of <i>Cardita</i> and <i>Glycymeris</i> -----	12
4. Species of <i>Cardium</i> , <i>Venericardia</i> , and <i>Parastarte</i> -----	12

#### ANODONTITES: A GENUS OF SOUTH AND CENTRAL AMERICAN AND MEXICAN PEARLY FRESH-WATER MUSSELS

By William B. Marshall

1. <i>Anodontites crispata</i> Bruguière-----	16
2. <i>Anodontites colombiensis</i> Marshall and <i>A. crispata</i> Bruguière-----	16

REPORT ON A COLLECTION OF INSECTS OF THE ORDER TRICHOPTERA  
FROM SIAM AND CHINA

By A. B. Martynov

Facing page

1. Species of <i>Rhyacophila</i> , <i>Glossosoma</i> , and <i>Stenopsyche</i> .....	20
2. Species of <i>Stenopsyche</i> , <i>Hydropsyche</i> , <i>Hydromanicus</i> , and <i>Asotocerus</i> ...	20
3. Species of <i>Pseudostenophylax</i> .....	20
4. Species of <i>Pseudostenophylax</i> , <i>Notopsyche</i> , <i>Eodinarthrum</i> , and <i>Goera</i> ....	20

REVISION OF THE AMERICAN PARASITIC FLIES BELONGING TO  
THE GENUS WINTHEMIA

By H. J. Reinhard

1. Species of <i>Winthemia</i> .....	54
--------------------------------------	----

A NEW MIDDLE CAMBRIAN MEROSTOME CRUSTACEAN

By Charles Elmer Resser

1. <i>Obolus johni</i> and <i>Beckwithia typa</i> .....	4
---	---

SOME NEW MIDDLE CAMBRIAN FOSSILS FROM BRITISH COLUMBIA

By Rudolf Ruedemann

1. <i>Dictyophycus gracilis</i> , new species.....	18
2. <i>Dictyophycus gracilis</i> , new species, and <i>Chaunograptus scandens</i> , new species.....	18
3. <i>Marrella splendens</i> Walcott and <i>Chaunograptus scandens</i> , new species..	18
4. <i>Chaunograptus scandens</i> , new species, and <i>Marria walcotti</i> , new species..	18
5. <i>Marria walcotti</i> , new species.....	18
6-7. <i>Marrella splendens</i> Walcott.....	18

DESCRIPTIONS OF NEW GENERA AND SPECIES OF SIAMESE FISHES

By Hugh M. Smith

1. <i>Garra taeniata</i> .....	1
--------------------------------	---

TEXT FIGURES

EXCAVATIONS AT A PREHISTORIC INDIAN VILLAGE SITE IN  
MISSISSIPPI

By Henry B. Collins, jr.

1. Plan of House Ring No. 1.....	1
2. Plan of House Ring No. 2.....	6
3. Plan of House Ring No. 3.....	7

TWO NEW SPECIES OF NEMATODE WORMS OF THE GENUS OSTER-  
TAGIA FROM THE VIRGINIA DEER, WITH A NOTE ON OSTERTAGIA  
LYRATA

By G. Dikmans

1. <i>Ostertagia lyrata</i> .....	3
-----------------------------------	---

NOTES ON AND DESCRIPTIONS OF SOME AMERICAN MOTHS

By Carl Heinrich

1. Work of <i>Anchylopera brauni</i> on buckthorn ( <i>Rhamnus</i> ) leaf.....	12
--	----

FOUR NEW SPECIES OF TREMATODE WORMS OF THE SUBFAMILY  
ONCHOCOTYLINAE

By G. A. MacCallum

Facing page

- |   |   |
|---|---|
| 1. Form of hooks of mouth suckers and small hooklets in appendix of<br><i>Squalonchocotyle canis</i> , <i>S. acanthi</i> , <i>Acanthonchocotyle musteli</i> , <i>Squa-</i><br><i>lonchocotyle vulgaris</i> , <i>S. sphyrynae</i> , and <i>S. squali</i> ..... | 3 |
|---|---|

DESCRIPTIONS OF A NEW GENUS AND EIGHT NEW SPECIES OF  
ICHNEUMON-FLIES, WITH TAXONOMIC NOTES

By C. F. W. Muesebeck

- |   |   |
|---|---|
| 1. Anterior wing of <i>Paroligoneurus johnsoni</i> , new species..... | 8 |
|---|---|

FOUR NEW SPECIES OF TREMATODE WORMS FROM THE MUSKRAT,  
ONDATRA ZIBETHICA, WITH A KEY TO THE TREMATODE PARA-  
SITES OF THE MUSKRAT

By Emmett W. Price

- |  |   |
|--|---|
| 1. <i>Psilostomum ondatrae</i> .....         | 2 |
| 2. <i>Echinochasmus schwartzi</i> .....      | 4 |
| 3. <i>Urotrema shillingeri</i> .....         | 8 |
| 4. <i>Paramonostomum pseudalveatum</i> ..... | 9 |

A NEW SPECIES OF TREMATODE OF THE FAMILY HETEROPHYIDAE,  
WITH A NOTE ON THE GENUS APOPHALLUS AND RELATED GENERA

By Emmett W. Price

- |   |   |
|---|---|
| 1. <i>Apophallus crami</i> , new species..... | 2 |
|---|---|

## SOME NEW MIDDLE CAMBRIAN FOSSILS FROM BRITISH COLUMBIA

By Rudolf Ruedemann

- |  |    |
|--|----|
| 1. <i>Bostrichopus antiquus</i> Goldfuss.....  | 6  |
| 2. Nauplius larva of <i>Lepas fascicularis</i> .....   | 8  |
| 3. Early growth stage of <i>Apus</i> .....   | 10 |
| 4. <i>Marrella splendens</i> .....   | 12 |
| 5. A young trilobite with large cephalon, showing in white the portion<br>preserved in the specimen of <i>Marrella splendens</i> ..... | 13 |
| 6. <i>Daphnia longispina</i> O. F. Müller.....   | 16 |

THE STEGOCEPHALID AND AMPELISCID AMPHIPOD CRUSTACEANS OF  
NEWFOUNDLAND, NOVA SCOTIA, AND NEW BRUNSWICK IN THE  
UNITED STATES NATIONAL MUSEUM

By Clarence R. Shoemaker

- |  |        |
|--|--------|
| 1-2. <i>Phippsiella minima</i> Stephensen.....     | 3, 4   |
| 3-4. <i>Andaniella pectinata</i> (G. O. Sars)..... | 6, 7   |
| 5-6. <i>Haploops spinosa</i> , new species.....    | 14, 15 |

## THREE NEW PARASITIC NEMATODE WORMS

By Mary Scott Skinner

	Facing page
1-6. <i>Metabronema canadense</i> .....	2
7-11. <i>Passalurus nonanulatus</i> and <i>P. ambiguus</i> .....	4
12-19. <i>Metathelazia californica</i> .....	6

## DESCRIPTIONS OF NEW GENERA AND SPECIES OF SIAMESE FISHES

By Hugh M. Smith

1. <i>Botia beauforti</i> .....	3
2. <i>Botia horae</i> .....	4
3. <i>Laubuca caeruleostigmata</i> .....	5
4. <i>Labeo bicolor</i> .....	10
5. <i>Cyclocheilichthys tapiensis</i> .....	11
6. <i>Puntius stigmatosomus</i> .....	14
7. <i>Barilius koratensis</i> .....	17
8. <i>Barilius pulchellus</i> .....	18
9. <i>Epalzeorhynchus siamensis</i> .....	21
10. Under side of head of <i>Scaphognathus stejnegeri</i> .....	23
11. <i>Scaphognathus stejnegeri</i> .....	23
12. <i>Mystus havmollerii</i> .....	24
13. <i>Pangasius sanitwongsei</i> .....	29
14. Maxillary and vomero-palatine teeth of <i>Pangasius sanitwongsei</i> .....	29
15. <i>Synaptura aenea</i> .....	32
16. <i>Gobiella pellucida</i> .....	34
17. <i>Thaigobiella sua</i> .....	36
18. <i>Eugnathogobius microps</i> .....	38
19. <i>Pipidonia quinquecincta</i> .....	39
20. <i>Paragobiodon kerri</i> .....	43
21. <i>Cryptocentrus leonis</i> .....	46
22. <i>Apocryptodon malcolmi</i> .....	48

## THREE NEW SPECIES OF POLYCHAETOUS ANNELIDS FROM CHESAPEAKE BAY

By Aaron L. Treadwell

1. <i>Pionosyllis manca</i> , new species.....	2
2. <i>Myriana cirrata</i> , new species.....	3
3. <i>Prionospio plumosa</i> , new species.....	4

## A NEW SPECIES OF NEMATODE WORM FROM THE SAGE GROUSE

By Everett E. Wehr

1-3. <i>Habronema urophasiana</i> .....	2
---	---

## DESCRIPTION OF A NEW GENUS AND SPECIES OF NEMATODE WORM OCCURRING IN THE NORTHWESTERN BELTED KINGFISHER, WITH A KEY TO THE GENERA OF THE SUBFAMILY ACUARIINAE

By Everett E. Wehr

1-5. <i>Aviculariella alcyona</i> , new species.....	2
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# THREE NEW SPECIES OF POLYCHAETOUS ANNELIDS FROM CHESAPEAKE BAY

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Among the polychaetous annelids collected in 1920-21 in the course of the biological survey of Chesapeake Bay, conducted by the United States Bureau of Fisheries, were found three undescribed species: Two representatives of the family Syllidae and one of the family Spionidae. The types have been deposited in the United States National Museum.

## Family SYLLIDAE

### PIONOSYLLIS MANCA, new species

#### Figure 1

The type is described from a female having a body width of 0.2 mm. and a total length of 2 mm. with 43 somites. The palps are fused dorsally for only a short distance, but ventrally they appear as two fleshy rounded lobes widely divergent from each other. The prostomium is three lobed (fig. 1, *a*), with the anterior lobe smaller than the lateral ones. Each anterior tentacle is attached just lateral to the depression between the corresponding lateral lobe and the anterior one and extends considerably beyond the palps. The median tentacle is attached near the posterior border of the prostomium and is long, slender, and of uniform width throughout. The lateral ones have narrow bases and expand into one or two flask-shaped enlargements beyond this. In some cases these have an appearance as if jointed (because of the constrictions between the enlargements), but this is entirely superficial. There are three pairs of eyes, the anterior ones very small and situated near the bases of the lateral tentacles, a larger pair near the posterior border of the prostomium, and a still larger pair a little anterior to these and near the lateral margin. Only the ventral tentacular cirri are present, and they resemble the lateral tentacles in form. The dorsal cirri also resemble the tentacular and are uniform in character throughout the body. The anal cirri are slender and longer than any of the dorsal cirri (fig. 1, *b*).

The body is of fairly uniform width throughout and is apparently a little more flattened anteriorly than posteriorly. Parapodia from the fourth to the seventh are somewhat more prominent than elsewhere, and their length is more than one-half the body diameter. Aside from a slight decrease in length toward the posterior end, later parapodia are similar to these in form. They all taper slightly toward the apex, which has a small posterior lip. The dorsal cirrus is considerably longer than the parapodium, and the ventral cirrus has the form of a blunt-ended elongated cone situated on the lower

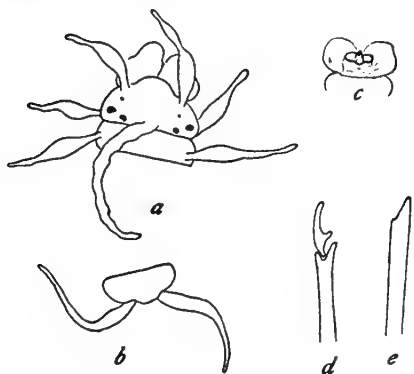


FIGURE 1.—*Pionosyllis manca*, new species: *a*, Anterior end,  $\times 75$ ; *b*, anal cirri,  $\times 75$ ; *c*, ventral view of proboscis with protruding tooth,  $\times 68$ ; *d*, compound seta,  $\times 550$ ; *e*, simple seta,  $\times 550$

face of the parapodium at some distance from its base and not reaching to the parapodial apex.

The pharynx is dark brown, its margin darker brown and smooth, with a single large median tooth. Figure 1, *c*, shows this tooth just protruding through the mouth as seen from the ventral surface with the palps forming the background. The proventriculus is colorless and inconspicuous, extending through only about three somites.

Two forms of setae apparently occur in all somites, cases where the simple ones are absent being evidently due to accident. Both kinds are long and very slender. The compound form (fig. 1, *d*) has a small terminal joint without any lateral denticulations. The simple seta is slightly heavier than the compound and is beveled at the end (fig. 1, *e*). Only one occurs in each parapodium, and it lies at the dorsal surface of the seta bundle.

The holotype (U.S.N.M. No. 19599) and paratypes were collected at Station 8835, off Cape Henry, Va., in 20 fathoms, July 9, 1920.

#### MYRIANA CIRRATA, new species

Figure 2

This new form is assigned to the genus *Myriana* because of its flat leaflike dorsal cirri and the absence of ventral ones. All specimens are variable in length; one 4 mm. long has a body width of 0.3 mm.

In the holotype the prostomium (fig. 2, *a*) is rounded anteriorly and has no trace of any palps. The eyes are large, those of the same side in contact; the anterior ones are a little farther apart than the posterior; lenses prominent. The median tentacle is the longest, reaching a length several times that of the prostomium. The lateral tentacles are similar to this in form but are shorter. The dorsal



tentacular cirri are shorter than the tentacles but in other respects agree with them in appearance. The ventral tentacular cirri (not shown in the figure) are short, and though a little longer than the dorsal cirri they resemble them in form.

The second somite has a tuft of compound setae and a long dorsal cirrus, which is similar to the tentacles in form but longer than they are. All other dorsal cirri are short, oval, and leaflike in outline. The pygidium (fig. 2, *b*) has the form of a thin, flattened lip, with a rounded posterior margin broader than the terminal somites. The anal cirri are shaped like the dorsal ones but are larger than any of them. Because the dorsal cirri of the shortened posterior somites are smaller than those farther forward, the anal cirri are very prominent.

The esophagus is narrow, has very dark-brown walls, and is bent on itself so that although the loop extends into somite 3, it opens into the pharynx in somite 2. The pharynx extends through about three somites, and the remainder of the canal behind this is very broad.

The parapodia are without ventral cirri. In the setal portion are a presetal and a postsetal lobe with the tuft of setae protruding between them. These lobes are approximately equal in size and are rounded at their apices. The

setae have very minute terminal joints (note the scale of the drawing in Figure 2, *c*), each roughly triangular in outline with a slender terminal and a much stouter subterminal tooth.

The holotype (U.S.N.M. No. 19603) was taken at Station 8828, July 8, 1920, near the mouth of Chesapeake Bay, in 16.47 meters. Others were taken at Stations 8826, 8827, 8840, 8829, and 8985 in the same locality in depths varying from 18.03 to 45.75 meters, July 8 to August 22, 1920, and April 2, 1921.

### Family SPIONIDAE

#### PRIONOSPIO PLUMOSA, new species

#### Figure 3

The largest specimens in the collection were 15 mm. long, but in none was the posterior end well preserved, so that they may have been longer when alive. The greatest width near the anterior end was 0.6 mm.

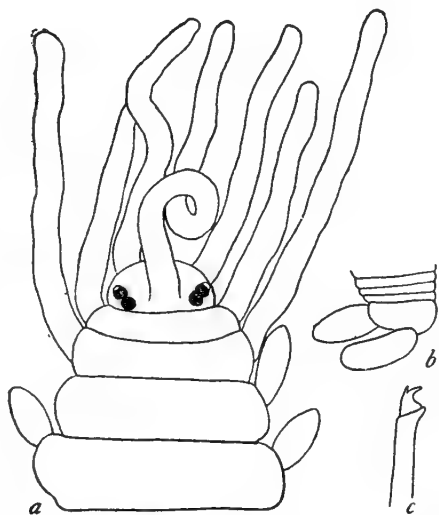


FIGURE 2.—*Myriona cirrata*, new species: *a*, Anterior end,  $\times 68$ ; *b*, pygidium,  $\times 68$ ; *c*, seta,  $\times 563$

The holotype has the basal portion of the prostomium (fig. 3, *a*) rounded and carries two pairs of reddish eyes, those of the anterior pair much farther apart than are the posterior. Just in front of the anterior eyes the prostomium narrows, and for a distance of a little more than twice its width it is continued forward as a parallel-sided lobe with rounded apex. The first somite is narrow on the dorsal surface (the boundary between this and the prostomium is not clearly marked off in my material), but laterally and ventrally it is continued forward in the form of an inverted hood underlying the prostomium for nearly its entire length and folding laterally so as almost entirely to obliterate it in a side view. When extended,

the proboscis is 2-lobed at the apex extending only for a short distance beyond the end of the prostomium (fig. 3, *c*).

I was unable to find any trace of tentacular cirri on any of this material.

The first setigerous somites have each a flattened cirruslike lobe posterior to the dorsal tuft of setae. From the first to the third there is gradual increase in size of these lobes and

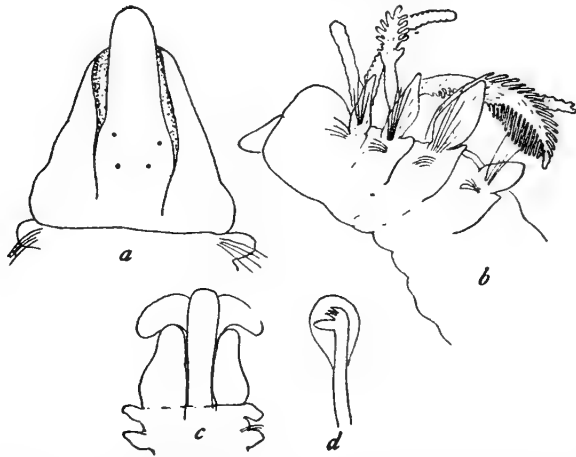


FIGURE 3.—*Prionospio plumosa*, new species: *a*, Dorsal view of prostomium,  $\times 45$ ; *b*, side view of prostomium,  $\times 20$ ; *c*, protruded pharynx,  $\times 20$ ; *d*, seta,  $\times 500$

then a gradual decrease, so that they practically disappear in the region of setigerous lobes 8 to 10. Similar but smaller lobes lie posterior to each seta tuft in the neuropodium. (Fig. 3, *b*.)

In this material the structure of the gills varies much in different specimens. So far as I can determine, the number should be three, but fewer are present in some cases, apparently because of loss. A fully developed gill has a naked base and a heavy central axis, carrying on either side a row of filaments, the longest filaments being in the middle of the series. The gills shown in Figure 3, *b*, represent three stages in gill development. First there is a slender tentaclelike process with crenulated margins from which later filaments grow out, as in the second of the gills figured, and finally these develop into the conditions shown in the third gill. The most profusely branched gill I have seen was the first pair in a specimen that retained no others. Apparently, therefore, the first gill does not always retain the tentaclelike character shown in the figure.

In anterior somites the setae of the dorsal tuft are all very long and slender and much curved, the longest lying at the top of the tuft and reaching beyond the base of the gill. Those of the ventral tuft are shorter than the dorsal but resemble them in other respects, but they curve in the opposite direction. On the ninth setigerous somite, hooded setae appear accompanied by slender simple ones. These hooded setae have a double hood, the double character, however, not being visible except when seen in full face. Each has a large sub-terminal tooth with a row of three much smaller ones beyond it. (Fig. 3, *d.*) Toward the posterior end of the body the dorsal setae are very few in number and are much elongated, some resembling those of the notopodium in the anterior somites, while others are hooded and resemble in form those of the neuropodium of the anterior somites. None of this material was sufficiently well preserved to allow of any accurate description of the posterior end.

In the form of the prostomium with its underlying prolongation from the under side of somite 1, this species resembles *Streblospio benedicti* of Webster, but lacks the prominent hoodlike structure on the dorsal surface of the second setigerous somite, which characterizes that species. The dorsal cirri are much more prominent in *P. plumosa*, while in *Streblospio* the margins of the gills are crenulated but never lobed.

The holotype (U.S.N.M. No. 19598) was taken at Station 8881, October 19, 1920, while other specimens were taken at Stations 8848, 8875, 8876, 8878, 8882, and 8887, ranging through the lower middle bay from the mouth of the Patuxent River to the mouth of the Rapahannock River, in depths of from 7.32 to 47.58 meters, August 22 to October 19, 1920.



# REVISION OF THE SPECIES OF BEETLES OF THE GENUS *TRIRHABDA* NORTH OF MEXICO

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## INTRODUCTION

The genus *Trirhabda* of the Chrysomelidae was described by LeConte<sup>1</sup> in 1865, and to it were assigned nine North American species, all of which are still commonly retained in the genus. They are, in order: *T. nitidicollis*, new species, *T. (Galleruca) canadensis* Kirby, *T. (Galleruca) luteocincta* LeConte, *T. (Galleruca) flavo-limbata* Mannerheim, *T. (Galleruca) attenuata* Say, *T. convergens*, new species, *T. (Chrysomela) tomentosa* Linnaeus, *T. virgata*, new species, and *T. brevicollis*, new species. No type has hitherto been designated for *Trirhabda*. In a discussion of the typification of *Trirhabda* and some related genera contributed by H. S. Barber to the present paper (pp. 2-3), the first species, *nitidicollis*, is selected as the type of LeConte's genus. LeConte's ninth and last species, *brevicollis*, differs from the others in many characters and is made, on page 32 of this paper, the type of a new genus.

LeConte characterized the genus as having the body large, elongate, not very convex, finely punctured, and pubescent; the head not at all carinate in front, the antennae with the third joint shorter than the fourth; the prothorax with a transverse impression; the elytra margined, with epipleura extending only halfway; the tibiae not sulcate; and the claws cleft. The usual color he described as pale, with a black occipital spot on the head, three discoidal spots on the prothorax, and broad sutural and discoidal black or green stripes on the elytra, these vittae coalescing in some species and leaving only the margin pale. He separated the genus from *Galerucella* and *Monoxia* by a difference in the proportion of the

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<sup>1</sup>Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 219, 1865. The exact date of publication of the number (for "October") in which LeConte's paper appeared is not known. The only available information is given in the note in the Index of the Contents of the Journal and Proceedings of the Academy, 1913: Vol. 17 (1865), no. 4 (pp. 173-236). "Receipt acknowledged by Albany Institute, Dec. 26, 1865."

third and fourth antennal joints—in the two latter genera the third joint is longer than the fourth—and by the short epipleura.

In the country north of Mexico there are few genera besides *Galerucella* and *Monoxia* likely to be confused with *Trirhabda*, but a few species of two closely related and mainly Central American genera have been found in the United States and described as species of *Trirhabda*. The species of these genera occurring in the United States are therefore included in this paper.

The only genus so closely related to *Trirhabda* as to be doubtfully distinct is the Central American *Nestinus*, described by the Rev. H. Clark,<sup>2</sup> also in 1865. Jacoby<sup>3</sup> found little to distinguish the two genera except the larger size of the species of *Nestinus*. It is evident, however, that in working up the diverse Central American material he referred to *Trirhabda* species belonging to other genera. The genus *Trirhabda* as outlined by LeConte is a homogeneous group, and *Nestinus* does not conform with it either in its larger size and very coarse sculpture or in its nonvittate elytral markings. In all the species of *Nestinus* thus far described there is no suggestion of vittation, a primary characteristic of *Trirhabda*. The aedeagus in *Nestinus* resembles in general shape that of *Trirhabda* but differs from it in lacking the thinly chitinated groove that in *Trirhabda* extends medially along the dorsal surface the greater part of its length.

H. S. Barber, who has long been interested in the problems of nomenclature involved in this group, has kindly prepared the following statement designating the genotypes of *Trirhabda* and a number of related genera:

Generic concepts of authors not being in agreement and objectionable changes in the application of names being possible, the following list of generic names with genotype designations may be useful; species of *Trirhabda* have been treated under all except *Pyrrhalta*, which was wrongly included in *Trirhabda* by Crotch, 1873:

*Chrysomela* Linnaeus, 1758, 78 species.

Genotype, *Chrysomela populi* Linnaeus, 1758, designated by Latreille, 1810.  
*Cryptocephalus* Geoffroy, 1762, 12 species without available names except the first and third, under which references to Linnaean species are given. The first species, now *Aegialastica alni*, was doubtless the best representative of the genus from the author's standpoint, but the genotype designation by Latreille, 1810, for the Fabrician genus *Cryptocephalus* can be and is hereby applied to the Geoffroyan genus by tracing back the citations under *sericeus* by Fabricius and Linnaeus to the species cited by Geoffroy from the prebinomial Fauna Suecica.

Genotype, *Chrysomela sericea* Linnaeus, 1758, designated by Latreille, 1810.

<sup>2</sup> Ann. and Mag. Nat. Hist., ser. 3, vol. 16, pp. 324, 325, Oct., 1865. The publishers of the Annals and Magazine of Natural History write, "To our knowledge it has always been published on the first day of the month."

<sup>3</sup> Biol. Centr. Amer. Coleopt., vol. 6, pt. 1, pp. 483, 485, Dec., 1886.

*Galeruca* Geoffroy, 1762. 5 species without names, but the first one with citation to the species chosen by Latreille.

Genotype, *Chrysomela tanacetii* Linnaeus, 1758, designated by Latreille, 1810.

*Galleruca* Fabricius, 1792 (emendation of *Galeruca*).

*Coelomera* Chevrolat, in Dejean, 1837, 31 species, most of them with invalid specific names. The species chosen for type of this genus as described by Chevrolat, 1844, is acceptable for its earlier establishment in the Dejean Catalogue.

Genotype *Chrysomela cayennensis* Fabricius, 1789, designated by Weise, 1924.

*Monocesta* Clark, 1865 (October 1), 24 species.

Genotype, *Monocesta imperialis* Clark, 1865, designated by Weise, 1924.

*Coraia* Clark, 1865 (October 1), 1 species.

Genotype, *Coraia maculicollis* Clark, 1865, monobasic.

*Nestinus* Clark, 1865 (October 1), 3 species.

Genotype, *Nestinus bimaculatus* Clark, 1865, present designation.

*Trirhabda* LeConte, 1865 (October ?), 9 species.

Genotype, *Trirhabda nitidicollis* LeConte, 1865, present designation.

*Pyrhalta* Joannis, 1866, 1 (?) species.

Genotype, *Galleruca viburni* Payk, 1778, monobasic (?).

*Trirhabda* Crotch, 1873 (typographical error).

*Trirhabda* Gemminger and Harold, 1876 (emendation or typographical error).

#### DESCRIPTION OF THE GENUS

The head in *Trirhabda* is punctate and pubescent on the occiput and vertex. The occipital spot is sometimes only a narrow darkened line down the vertical fovea that is present in all species, or it may cover the entire base of the head and partly encircle the eyes. Yet in all species except two<sup>4</sup> that have been hitherto placed in *Trirhabda*, this occipital spot is present, and its shape, size, and color are of considerable specific importance. The antennal joints are variable, with the fourth always longer than the third. The third and fifth antennal joints are usually not equal, although in a given species they may vary slightly.

The prothorax in most species appears transversely depressed, but this may be due to the collapse of soft tissues. It is usually approximately twice as broad as long, sometimes less, rarely more. The margin as viewed from above is usually arcuate, but may be distinctly angulate medially. The apical and the basal angles have a tiny nodule. The surface is usually either alutaceous or shining with scattered coarse punctures, rarely impunctate; sometimes it is pubescent. It is pale yellow or brown and always has three spots varying in size, color, and shape, two lateral and one median.

The color of the scutellum is an important character also. In species in which the pale color predominates, the scutellum is often bicolored.

<sup>4</sup> *T. brevicollis* and *T. ornata*—here referred to a new genus; see pp. 33, 34.

The elytra are subparallel, with a narrow margin, and are confusedly punctate, the sculpture varying from very finely to rather coarsely rugose, and, except in one or two species, they are always more or less pubescent. In markings the species may be superficially divided into three classes—the vittate; the unicolorous, except for the pale margin; and the pale-brown desert species, in which the only traces of vittation are variable shoulder streaks and darkened sutural margins. The most common and typical pattern, as denoted by the generic name, is the trivittate form, with common sutural vitta and two lateral vittae always found in *canadensis* and *nitidicollis*. When the vittae begin to coalesce, there are specimens with traces of a median vitta, such as occurs commonly in *diducta* and *geminata* and occasionally even in *lewisii* and *confusa*. When the median pale area is reduced still more, such examples occur as the vittate *convergens*, *neoscotiae*, and many specimens of *lewisii*. A still further development of the dark vittae results in reducing the pale median area to a degree that is typical of such species as *bacharidis*, *attenuata*, and *pilosa*. Then come the species with the elytra entirely dark except for the margin. But in each species, with few exceptions, a varying degree of vittation is found. For instance, both vittate and entirely dark specimens may be found in *convergens*, *luteocincta*, *confusa*, and *sericotrachyla*. In the other direction, there are the pale, faded-out, arid-country forms with only remnants of vittae, such as *nigrohumeralis* and *eriodictyonis*. The best illustration of variation within a species among these is *geminata*, which ordinarily has lateral, sutural, and an abbreviated median vitta, but may have only a lateral and sutural vitta (in one specimen in the collection of the University of Kansas), or may lack all trace of vittation except for a darkened humeral spot, or, again, the elytra may be nearly piceous. In fact, *canadensis* and *nitidicollis* are exceptional in not having various degrees of coalescence in their vittate markings. The elytra as a whole are pale brown or yellow, with piceous, black, metallic-blue, green, violet, or deep indigo markings. The species occurring east of the Mississippi River (with the exception of *neoscotiae*, in which the vittae appear almost black in some lights but are really deep blue or green) all have piceous markings without metallic luster. A few are very shining and brilliant, but the majority, because of the pubescence and alutaceous surface, are duller. The dried museum specimens, for the most part, are drab and collapsed, but the fresh specimens are beautifully colored. The original color as well as the shape in this genus is best preserved by putting the fresh specimens in formalin for a few days.

The body beneath is pale, often with darker margins and sometimes with entirely dark metasternum and abdomen, frequently with a metallic luster. The legs are usually pale, but in some species



the outer sides are darkened. The principal leg characters differentiating *Trirhabda* as a genus are (1) the first tarsal joint longer than the following joints, (2) the absence of a well-marked external sulcus in the tibia, and (3) the bifid claws.

The size and shape of the aedeagus furnish good specific characters, which may well be used also to indicate generic boundaries. As it is extremely difficult to interpret descriptions of the shape of the aedeagus, I have in all species made a drawing of the dorsal view showing the shape of the tip, which varies greatly in length and shape—in some it is short and blunt, in others long and tapering; in some pointed, in others rounded; but in all the species the aedeagus is long and narrow and with a more or less acute, never truncate tip. In the *convergens* group the aedeagus varies but little. It may be that the whole group is a single species that has become separated into races in its wide geographic range, and these races have become quite different in coloring and markings. I am unable to inflate the internal sac of the aedeagus and do not know if even that would be of value in determining the species. In the *luteocincta* group the aedeagus is peculiar in its long tapering tip. Under *luteocincta* have been grouped two other species whose differences no one had suspected, but dissection revealed aedeagi so unlike that I at once began to hunt for and find external characters. The same was true of *canadensis* and *adela*, *attenuata* and *pilosa*, *virgata* and *borealis*.

The quite different structure of the aedeagus of *T. brevicollis* first led me to suspect that it might belong to a different genus. Later the dissection of a Mexican *Monocesta* brought to light the same sort of aedeagus. This *Monocesta* is closely related to if not identical with Schaeffer's *Trirhabda ornata*, of which I have seen only a single specimen, the type. *T. ornata* without doubt would have a similar aedeagus. Besides having a different aedeagus from *Trirhabda*, these three species have a differently shaped prothorax and are further distinguished by minor details of coloring and pubescence, and are herein described (p. 32) as a new genus. In addition to figures of the aedeagi of all the species of *Trirhabda*, I have given drawings of those of one or more species of each of the three closely allied genera, species of which have been ascribed to *Trirhabda*.

#### EGGS AND LARVAL HABITS

The life history of one of the most widespread species of *Trirhabda*, *T. canadensis*, an account of which by W. V. Balduf has been published,<sup>5</sup> is probably typical of the genus. The eggs, laid on the ground, are in clusters glued together by some strong adhesive and

<sup>5</sup> Ent. News, vol. 40, no. 2, pp. 35-39, 1929.

are thick shelled and tough. The genus is peculiar in that it passes the winter in the egg stage rather than the adult, as is usually the case in the Chrysomelidae. The fragile, thin integument of the adult is ill fitted to weather the snows of winter or the parching droughts of arid regions, particularly in the northern climates, which *Trirhabda* as a rule inhabits.

Although the larvae of *T. canadensis* are conspicuous in their glistening blackness on the tops of goldenrod, they do not compare with the brilliant metallic-lustrous larvae of *T. bacharidis* or of some of the western species. A detailed description of the larva of *canadensis* and notes on other species are given in Dr. Adam G. Boving's paper on Beetle Larvae of the Subfamily Galerucinae.<sup>6</sup>

The larvae go into the ground just below the surface, where they form cases in which to pupate. The pupal stage lasts a week or two, evidently depending somewhat on climatic conditions. The height of the season of adults is late in June or in July in the latitudes of Washington, D. C., and Los Angeles and San Francisco, Calif. In Massachusetts, adults of *virgata* occur in numbers in August, and in the Yellowstone National Park I took adults of three species, two in abundance, early in September. Early in June at the Grand Canyon, Ariz., I found nearly mature larvae of another species. One generation a year is apparently the rule.

As far as known, the larvae remain feeding on the tender foliage of their food plant. In *T. brevicollis*, in this paper referred to another genus (see p. 33), a different habit is recorded by J. D. Mitchell, who writes, "The larvae burrow into the ground where it is slightly raised, making runs or galleries, from which they crawl out and about day and night, but never more than a few inches from the colony home."<sup>7</sup>

#### GEOGRAPHIC DISTRIBUTION AND VARIATION

The genus as a whole belongs to the Transition and Boreal Zones. In most species the food plant is a composite, particularly goldenrod (*Solidago*) in the East and sagebrush (*Artemisia*) in the arid country of the West. The eastern species are few and not very variable in markings. Of the six species known to occur in the Eastern States, *canadensis*, *bacharidis*, and *virgata* are most common. Both *canadensis* and *virgata* feed on goldenrod, and occur from Canada southward, but are increasingly scarce south of New Jersey. *T. bacharidis* feeds on the salt-marsh composite *Baccharis*, which occurs on the coast all the way from southeastern Massachusetts to the Gulf of Mexico. *T. canadensis* and *T. virgata* extend across the northern

<sup>6</sup> Proc. U. S. Nat. Mus., vol. 75, art. 2, pp. 1-48, 1929.

<sup>7</sup> Chittenden, F. H., U. S. Dept. Agr., Div. Ent. Bull. 38, n. s., p. 108, 1902.

part of the United States and southern Canada, *canadensis* reaching the Pacific coast, although *virgata* is not found beyond the Great Plains.

A small group of three boreal species, the *convergens* group, all occurring on goldenrod, is found (1) in Nova Scotia, (2) along the shores of Lake Superior in Ontario and Wisconsin, to Manitoba and Alberta, and (3) in Alberta and in the Rocky Mountains southward to New Mexico. These species are all closely related and may be merely geographic varieties of one northern species. They are all small (the smallest of the genus) and similar in sculpture and pubescence, all have darkened ventral surface and heavy occipital and pronotal markings, and all have similar aedeagi. They differ chiefly in elytral coloring and present little intergradation in their separate localities. The Nova Scotia species is as readily separable from the Lake Superior species as both are from the Alberta and Rocky Mountain species. Moreover, the Lake Superior species has been found in Alberta preserving its distinctive coloration. Because they are so readily separated, I have given names to each form, although structurally there is little to distinguish them. Another northern species, *borealis*, extends from Massachusetts through Michigan and the Dakotas to Montana and Washington, but is recorded south of these States only from West Virginia, where it probably was found in the mountains, and from Kansas and Missouri. Four species are almost confined to the area from the Great Plains west through the Rocky Mountains. *T. lewisii* is restricted to the Rocky Mountain region and lives on *Chrysothamnus*. *T. nitidicollis*, also found on *Chrysothamnus*, occurs from Wyoming to Arizona and New Mexico and into the arid southern part of California. It presents many color variations, although the pattern of the markings is quite uniform throughout its range. *T. attenuata* feeds on both goldenrod and sagebrush, and has a range from the Great Plains (Kansas and Nebraska) to Alberta and through the northern Rocky Mountain region in the United States. *T. pilosa* extends from Wyoming and Nevada into the Sierra Nevada in California.

On the Pacific coast the species of *Trirhabda* are manifold, with extremely variable markings, and present most interesting relationships. *T. luteocincta* occurs on the southern coast of California on a species of *Aplopappus*, and *T. labrata*, its close relative, is found about Monterey on *Aplopappus ericoides*. Another closely related species, *confusa*, said to be a sagebrush feeder, is found chiefly inland, and still another, *sericotrachyla*, which has hitherto been confused with *luteocincta*, appears to be found only along the coast from San Diego to Los Angeles. *T. flavolimbata*, which feeds on *Baccharis pilularis*, has been collected only in the San Francisco region.

Among the arid-region forms is *eriodictyonis*, known chiefly from the Mojave Desert region and found on a species of *Eriodictyon* (Hydrophyllaceae). One other California species, *diducta*, also feeds on *Eriodictyon*, but occurs as far north as San Francisco. These two species breeding on *Eriodictyon* are so closely related that one is almost tempted to call them varieties of the same species. *T. diducta* ranges southward and inland to Nevada, and specimens from around Fresno are difficult to separate in general appearance from *eriodictyonis*. Another very distinct species, *caduca*, described by Horn, has not been found outside Owens Valley. Two other species, *geminata* and *nigrohumeralis*, with the pale-brown coloring typical of forms from arid regions, occur in New Mexico and Arizona, and *geminata* extends to the Pacific coast through southern California, but specimens collected there usually have much darker, almost piceous, elytra.

*T. brevicollis*, not a true *Trirhabda*, feeds on prickly-ash (*Zanthoxylum*) and occasionally is a pest on orange, both belonging to the Rutaceae. It is found in the Gulf States and north in the Middle States even to Michigan. *T. ornata*, also referred to the same genus, is found only in Texas, and *T. (=Coraia) subcyanescens* has been recorded only from the southern tip of Texas in Cameron and Hidalgo Counties.

Without a fully representative collection, it is extremely difficult to identify specimens of *Trirhabda*. The genus is homogeneous, possessing few structural characters by which to separate the species; the species are with few exceptions variable in elytral markings and coloring, and as a rule they can not be determined by their food plant, since the majority feed on goldenrod or sagebrush or both. The key here given will probably not prove satisfactory to those who are not somewhat familiar with the group. In species that are similar in external appearance, the shape of the aedeagi is of great help in the identification.

In designating paratypes of the new species, I have taken care to list only other specimens bearing the same data as the type, although in all cases a larger number of specimens of the species was at hand. This is not generally the practice in entomology at present, but in the case of a genus in which the species are so closely related and so easily confused, it is desirable that the paratypes should be as nearly as possible equivalent to the type.

I have been fortunate in having many collections placed at my disposal, and wish to thank the following men for their kindness in sending me their own collections or those in their care: Nathan Banks and P. J. Darlington, of the Museum of Comparative Zoology, Cambridge, Mass.; C. W. Johnson, of the Boston Society of Natural

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## KEY TO GENERA

1. Third and fourth antennal joints approximately equal or third slightly the longer; a distinct ridge or sulcus on outer edge of tibia extending its entire length----- 2  
 Third antennal joint distinctly shorter than fourth; sulcus on outer edge of tibia indistinct, not extending its entire length----- 3
2. Body dilated posteriorly; prothorax more than twice as broad as long, with arcuate sides; antennae not longer in male----- **Monocesta**  
 Body parallel; prothorax subquadrate, scarcely twice as broad as long, sides tending to be straight or slightly angulate at middle; antennae longer and more robust in male----- **Coraia**
3. Aedeagus short, truncate; prothorax considerably more than twice as broad as long; head glabrous----- **Derospidea**, new genus  
 Aedeagus long, acute at tip; prothorax approximately twice as broad as long; head pubescent----- **Trirhabda**

## KEY TO THE SPECIES OF TRIRHABDA

1. Occipital and pronotal spots and elytral vittae piceous or black without metallic luster----- 2  
 Occipital or pronotal spots or vittae or entire elytra except for margin dark with metallic luster----- 12  
 Occipital and pronotal spots and remnants of elytral vittae reddish brown to piceous. Species of the arid Southwest----- 29
2. Pronotal surface between coarse punctures smooth and shining----- 3  
 Pronotal surface between coarse punctures alutaceous----- 4
3. Elytra coarsely punctate, with short, very sparse pubescence; sutural vitta only a narrow darker border of sutural edges, lateral vitta narrow, more or less evanescent; pronotum usually coarsely punctate, not polished. Owens Valley, Calif.----- **caduca** (p. 31)  
 Elytra finely punctate, finely and densely pubescent; sutural and lateral vittae usually united at apex; pronotum sparsely punctate, polished. Rocky Mountains and southern California----- **nitidicollis** (p. 23)
4. Elytra with lateral and sutural vittae united before or slightly behind middle or with traces of median vitta coalescing with lateral vitta----- 5  
 Elytra with lateral and sutural vittae distinct and not united before apex, no median vitta----- 7

5. Large (7 mm. to 12 mm.) ; elytra finely and densely pubescent ;  
vittae coalescing shortly behind middle. Atlantic seacoast on  
*Baccharis*----- *bacharidis* (p. 12)  
Smaller (5 mm. to 9 mm.) ; elytra not densely pubescent ;  
usually on *Solidago* or other dry-land composite----- 6
6. Lateral and sutural elytral vittae usually distinct, with traces  
of median vitta, sometimes coalescing, sometimes evanescent ;  
pronotum densely and coarsely punctate. Southwestern  
United States----- *geminata* (p. 31)  
Lateral and sutural vittae united behind middle ; pronotum with  
scattered coarse punctures. Southeastern United States.  
----- *virgata* var. (p. 16)
7. Occipital spot small, oblong, not forming a transverse basal  
band or extending broadly down front ; elytra densely pu-  
bescent, finely punctate----- *canadensis* (p. 13)  
Occipital spot either a wide transverse basal band or extending  
broadly down front----- 8
8. Elytral vittae on close examination deep blue or green, although  
appearing black ; body beneath mostly dark. Nova Scotia.  
----- *neoscotiae*, new species (p. 17)  
Elytral vittae always entirely piceous or black ; body beneath  
usually pale, often with a narrow dark margin, this occasion-  
ally widening ----- 9
9. Scutellum usually with pale tip ; elytra inconspicuously pu-  
bescent, finely punctate----- *lewisii* (p. 22)  
Scutellum black ; elytra distinctly pubescent and, except in  
*adela*, distinctly and often coarsely punctate----- 10
10. Elytra densely pubescent, covering fine punctation.  
----- *adela*, new species (p. 14)  
Elytra not densely pubescent, the coarse sculpture apparent----- 11
11. Robust (6 mm. to 9 mm.), coarsely punctate ; occipital spot  
usually widely oblong and extending down front ; aedeagus  
broad with short tip (see pl. 1, fig. 4)----- *virgata* (p. 15)  
Slenderer (5.5 mm. to 8 mm.), not so coarsely punctate ; occip-  
ital spot a transverse basal band curving down front ;  
aedeagus gradually narrowed at tip (see pl. 1, fig. 5).  
----- *borealis*, new species (p. 16)
12. Pronotum conspicuously pubescent----- 13  
Pronotum either entirely glabrous or very inconspicuously and  
sparsely pubescent ----- 15
13. Abdomen entirely dark except for last segment ; elytra green  
except for pale margin and small basal vitta not reaching  
middle, smaller (4.5 mm. to 6.8 mm.)----- *pilosa*, new species (p. 20)  
Abdomen never entirely dark, usually pale with narrow darker  
margin ; elytra except for pale margin entirely blue or green,  
or with lateral, sutural, and traces of median vittae ; larger  
(5 mm. to 8 mm.)----- 14
14. Pronotal spots large ; pronotum coarsely and densely punctate.  
California----- *sericotrachyla*, new species (p. 28)  
Pronotal spots small ; pronotum not densely punctate. Rocky  
Mountains and Great Plains----- *attenuata* (p. 21)
15. Pronotum not alutaceous, more or less shining----- 16  
Pronotum distinctly alutaceous----- 24

16. Pronotal spots entirely without metallic luster, usually small or moderate sized----- 17  
 Pronotal spots with metallic luster, usually large----- 21
17. Sutural vitta entirely absent or at most represented only by darkened sutural edges, lateral vitta often reduced to an elongate humeral spot. Southern California----- *eriodictyonis* (p. 24)  
 Lateral and sutural vittae well marked, sometimes a median vitta, sometimes elytra entirely dark except for pale margin----- 18
18. Pronotum very smooth, not depressed, polished; spots usually small; elytra never with median vitta or entirely dark. *nitidicollis* (p. 23)  
 Pronotum somewhat depressed, not so shining; spots usually moderate-sized; elytra either with median vitta or entirely dark except for margin----- 19
19. Elytra with long, dense, silky pubescence covering the punctation, sometimes entirely blue or green except for margin, sometimes vittate with median vitta----- *confusa*, new species (p. 27)  
 Elytra with sparser, shorter pubescence, the punctation distinctly visible----- 20
20. Occipital spot black, narrowly oblong down front; elytra usually with short median vitta, never entirely dark, punctation fine----- *diducta* (p. 25)  
 Occipital spot with metallic luster, curving broadly over head, often forming transverse basal band; elytra entirely blue or green except for margin and rather coarsely punctate. *flavolimbata* (p. 29)
21. Very brilliantly metallic, with broad shining blue or green occipital basal band, and large, often contingent, lustrous pronotal spots; elytra inconspicuously pubescent and coarsely punctate, shining blue or green except for margin----- *labrata* (p. 28)  
 Metallic luster more or less obscured by pubescence, the occipital band and pronotal spots not so lustrous nor usually so large; elytra distinctly pubescent and with finer punctation----- 22
22. Oblong oval, elytra rather coarsely punctate, never vittate, pubescence not long and silky (5 mm. to 8 mm.). About San Francisco----- *flavolimbata* (p. 29)  
 Parallel (7 mm. to 10.5 mm.); elytra with long silky pubescence, sometimes vittate. Southern California and inland----- 23
23. Large (8.5 mm. to 10.5 mm.); abdomen mostly dark with metallic luster, prothorax much depressed, its large spots with distinct metallic luster. Along seacoast, southern California. *luteocincta* (p. 26)  
 Smaller (7 mm. to 8.5 mm.); abdomen pale, sometimes with margin dark metallic; prothorax with smaller spots with indistinct metallic luster. Along seacoast, southern California and inland, extending to Oregon line-- *confusa*, new species (p. 27)
24. Elytra finely and inconspicuously punctate; body beneath never entirely dark; scutellum often with pale tip----- 25  
 Elytra rather coarsely punctate; body beneath usually more or less darkened (not in *borealis* var. *indigoptera*); scutellum always dark----- 26
25. Elytra inconspicuously pubescent; pronotal spots moderately large; lateral and sutural vittae usually distinct and united at apex, occasionally coalescing before apex----- *lewisii* (p. 22)

- Elytra with fine, white pubescence; pronotal spots small, median one situated nearer base of pronotum than anterior margin; lateral and sutural vittae usually coalescing behind middle, rarely the attenuated median pale vitta extending much below middle----- *attenuata* (p. 21)
26. Large (6 mm. to 8 mm.); elytral vittae very dark, appearing black, but with indistinct blue, purple, or, rarely, green hue; abdomen mostly pale----- *borealis indigoptera*, new variety (p. 17)
- Smaller (5 mm. to 6.5 mm.); elytral vittae or entire elytra (in species with elytra dark except for margin) with green or blue luster, more or less pronounced; abdomen always dark----- 27
27. Elytral vittae inconspicuously green or blue, appearing nearly black. Nova Scotia----- *neoscotiae*, new species (p. 17)
- Elytral vittae or entire elytra except for margin with distinct metallic luster. Great Lakes westward----- 28
28. Elytra usually entirely blue or green, the vittae in vittate forms usually not united at apex; elytra only moderately pubescent; body beneath dark without metallic luster, paler in vittate forms. Great Lakes, Wisconsin, Manitoba, Alberta. *viridicyanea*, new species (p. 19)
- Elytra entirely green except for margin, or in vittate forms with wide lateral and sutural vittae united at apex; elytra densely pubescent; body beneath dark with metallic luster. Rocky Mountains----- *convergens* (p. 18)
29. Elytra coarsely punctate, very sparsely pubescent----- *caduca* (p. 31)
- Elytra not coarsely punctate, finely and densely pubescent----- 30
30. Pronotum densely and coarsely punctate; elytra usually with median vitta or traces of it, or entirely reddish brown or piceous----- *geminata* (p. 31)
- Pronotum sparsely and coarsely punctate; elytra never with median vitta or entirely dark----- 31
31. Prothorax not angulate, alutaceous; elytra with only small dark humeral spot, not with metallic luster; small (5 mm. to 7 mm.). Arizona and New Mexico----- *nigrohumeralis* (p. 30)
- Prothorax usually angulate, shining; elytra usually with elongate humeral spot, and usually with metallic luster; larger (5 mm. to 9 mm.). Southern California----- *eriodictyonis* (p. 24)

# 1. *TRIRHABDA BACHARIDIS* (Weber)

## Plate 1, Figure 1

*Galleruca bacharidis* WEBER, *Observationes Entomologicae*, p. 57, 1801.—FABRICIUS, *Syst. El.*, vol. 1, p. 480, 1801.—OLIVIER, *Ent.*, vol. 6, p. 629, pl. 3, fig. 34, 1808.

*Trirhabda tomentosa* LECONTE, *Proc. Acad. Nat. Sci. Philadelphia*, vol. 17, p. 220, 1865. Probably not *Galleruca tomentosa* Linnaeus, *Syst. Nat.*, ed. 12, vol. 1, pt. 2, p. 601.

*Description*.—Robust, subparallel, pale yellow, with darkened antennae and tarsi, black occipital and three thoracic spots, and wide lateral vitta joining with sutural vitta below middle. Head pale with dark mouth parts and occipital plaga extending narrowly down



**vertex**; alutaceous with dense coarse punctation over occiput, lightly pubescent. Antennae with third joint short and robust, considerably shorter than fifth. Prothorax approximately twice as broad as long; sides only slightly arcuate with small median angle; surface alutaceous with sparse, coarse punctures; pale yellow with the usual three black spots of medium size. Scutellum black. Elytra densely, shallowly, and confluent punctate and covered with short, dense, pale pubescence; sutural and wide lateral vittae usually joined after middle (in some Louisiana specimens vittae joined at middle). Body beneath pale with margins of metasternum and abdomen darkened, tarsi also dark. Length, 7.5 mm. to 12 mm.; width, 3.5 mm. to 4.5 mm.

*Type locality*.—Eastern North America.

*Distribution*.—New York (Huntington, L. I.); Maryland (Chesapeake Beach); District of Columbia (Washington); Virginia (Virginia Beach); North Carolina (Wilmington); South Carolina (Charleston and Holly Hill); Georgia; Florida (Crescent City); Louisiana (New Orleans and Baton Rouge).

*Food plant*.—Groundselbush, *Baccharis halimifolia* Linnaeus.

*Remarks*.—This species has been known as *tomentosa* Linnaeus since LeConte identified it with *Galleruca tomentosa* Linnaeus, possibly following Illiger's statement.<sup>8</sup> But Linnaeus compares the size of *tomentosa* with that of *G. capreae*, the European *Lochmaea capreae*, a far smaller beetle about 5 mm. long. As this species of *Trirhabda* is one of the largest, averaging about 10 mm., it does not seem probable that Linnaeus could have had it before him in writing his description, but rather some species of *Galerucella*. Weber's description and Olivier's figure, as well as the name indicating the food plant, leave no doubt that Weber's description refers to the common coastal species of *Trirhabda* of eastern North America found on *Baccharis*.

## 2. TRIRHABDA CANADENSIS (Kirby)

### Plate 1, Figure 2

*Galleruca canadensis* KIRBY, Fauna Boreali-Americana, part 4, p. 219, 1837.  
*Trirhabda canadensis* LECONTE, Proc. Acad. Nat. Sci. Philadelphia, p. 219, 1865.  
*Trirhabda canadensis* var. *tomentosa* CROUCH, Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 56, 1873.

*Description*.—Elongate, pale yellow, with darkened antennae and tarsi and sides of abdomen, and with small black occipital and usual pronotal spots; black sutural and lateral vittae on elytra narrow and joined at apex. Head alutaceous with coarse punctures, moderately pubescent, an oblong black spot on occiput extending down front.

<sup>8</sup> Mag. für Insektenkunde, vol. 6, p. 146, 1807.

Antennae with third joint shorter than fifth. Prothorax not twice as broad as long, with sides slightly arcuate, angles small, not prominent; surface alutaceous with scattered coarse punctures; spots small and black, median one tending to be diamond-shaped. Scutellum entirely black. Elytra densely but finely punctate, and covered with dense pale pubescence; lateral and sutural vittae only moderately wide and usually united at apex. Body beneath mostly pale, frequently with dark margins to metasternum and abdomen. Length, 7 mm. to 10 mm.; width, 3 mm. to 4 mm.

*Type locality*.—Canada. Collected by Doctor Bigsby, probably north of the Great Lakes or the St. Lawrence River.

*Distribution*.—Ontario, Manitoba, Saskatchewan, Alberta, British Columbia, Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Maryland, West Virginia, Michigan, Illinois, Kansas, Nebraska, South Dakota, Montana, Idaho, Colorado, Wyoming, Utah, Nevada, Arizona, New Mexico, California ("Siskiyou"), and Washington.

*Food plant*.—Goldenrod, *Solidago*.

*Remarks*.—This is probably the most widespread species of the genus, although its occurrence in the southern Atlantic and Gulf States has not been recorded. It is unlikely that Kirby's description applies to any other species, as there is no vittate northern *Trirhabda*, except this species, having a "dot" for an occipital spot. It varies little in markings in its wide range. The lateral and sutural vittae are usually united at the apex; the occipital and pronotal spots are small. The dense elytral pubescence and fine punctation at once distinguish it from *virgata*, while the somewhat depressed and finely alutaceous pronotum distinguishes it from *nitidicollis* with its polished, smooth pronotum.

### 3. *TRIRHABDA ADELA*, new species

#### Plate 1, Figure 3

*Description*.—Of same general appearance as *T. canadensis*, but usually with a broad black plaga extending across occiput and larger, rounded spots on pronotum; pronotum also with more arcuate sides, and elytral vittae not united. Head coarsely, rugosely punctate, moderately pubescent, with wide black plaga extending across occiput and down front. Antennae with third joint shorter than fifth. Prothorax about twice as broad as long with arcuate sides and feeble angles; alutaceous with scattered coarse punctures; spots larger and rounder than in *canadensis*. Scutellum black. Elytra a little more coarsely punctate than in *canadensis*, densely and finely pubescent; black sutural and lateral vittae moderately wide and usually not united at apex. Body beneath sometimes with abdomen entirely

dark, usually with only margin of metasternum and abdomen dark. Length, 6 mm. to 10 mm.; width, 2.8 mm. to 4.5 mm.

*Type*.—Collected by E. R. Kalmbach, July, August, 1912, at Bountiful, Utah. U. S. N. M. No. 43016 (with 11 paratypes).

*Distribution*.—"Hudson's Bay Territory," Illinois, Maryland, North Dakota, South Dakota, Kansas, Missouri, Texas, Wyoming, Montana, Utah, Nevada, California.

*Food plants*.—Thistle, *Cirsium* sp. (I. N. Gabrielson, North Dakota); tall goldenrod, *Solidago altissima* (J. C. Bridwell, Glen Echo, Montgomery County, Md., near Washington, D. C.).

*Remarks*.—This species has always been confused with *canadensis*, which it closely resembles in size and general coloring. There are structural differences, however, in the shape of the tip of the aedeagus, besides the difference in the shape of the prothorax, with its more arcuate sides. The markings are also slightly different. There is a much wider basal plaga across the head, the pronotal spots are larger and rounder, and the elytral vittae do not ordinarily unite at the apex of the elytra as in *canadensis*. The elytra, too, are a little more coarsely punctate.

It has been collected chiefly west of the Mississippi River, although a large series from Illinois is in the collection of the Illinois State Natural History Survey, and a series was taken by J. C. Bridwell in the Potomac River Valley at Glen Echo, Md.

Specimens of this species in Blanchard's collection are labeled by him as "*western canadensis*."

#### 4. TRIRHABDA VIRGATA LeConte

##### Plate 1, Figure 4

*Trirhabda virgata* LeConte, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 220, 1865.

*Description*.—Oblong, robust, coarsely punctate, pale with darkened antennae, with black occipital spot, three moderately large pronotal spots, and wide piceous lateral and sutural vittae, usually not united at apex. Head alutaceous with obsolete coarse punctures; usually a wide, oblong, black occipital spot extending down front and covering base of head (shown when head is protruded); sparsely pubescent. Antennae robust, with third joint much shorter than fifth. Prothorax approximately twice as broad as long, usually obtusely angulate; surface dull and strongly alutaceous with scattered, coarse, shallow punctures; spots moderately large. Scutellum entirely black. Elytra coarsely and confluent punctate, inconspicuously and rather sparsely pubescent; lateral and sutural vittae wide, the former usually wider than inclosed pale vitta, these dark vittae

seldom uniting at apex. Body beneath with sides of metasternum and abdomen more or less darkened. Length, 6 mm. to 9 mm.; width, 2.5 mm. to 4 mm.

*Type locality*.—"Middle and Southern States."

*Distribution*.—Nova Scotia (Halifax); Ontario (?) ("Windsor"), New Hampshire (Chocorua); Massachusetts; Connecticut; Rhode Island; New York; New Jersey; Pennsylvania; Ohio; Illinois; Wisconsin; South Dakota (Brookings); Kansas; Missouri; Texas (Belfrage collection); Alabama (Tumblin Gap and Monte Sano); Georgia (Stone Mountain).

*Food plant*.—Goldenrod, *Solidago*.

*Remarks*.—The coarse, shallow punctation and sparse pubescence of the elytra at once distinguish this from the finely punctate, densely pubescent *canadensis* and *adela*, and the sparse pubescence separates it from the larger species, *bacharidis*. One specimen from Stone Mountain, Ga., collected by P. W. Fattig, and two from Alabama, collected by H. P. Löding, I have rather doubtfully placed with *virgata*. They are more slender and parallel and distinctly (not so confluent) punctate on the elytra, and are more heavily marked, the occipital spot becoming a wide basal band, and the elytral vittae joining at the apex. In the Stone Mountain specimen the vittae widen so as to coalesce shortly behind the middle, leaving only a very narrow, pale, abbreviated vitta as in *bacharidis*. All three specimens unfortunately are females.

5. *TRIRHABDA BOREALIS*, new species

Plate 1, Figure 5

*Description*.—Small, oblong, pale; head with wide black occipital band, prothorax with three black spots, elytra with wide black sutural and lateral vittae; elytra more finely punctate than in *virgata*. Head alutaceous with obsolete shallow punctation, very lightly pubescent; occipital band across base curving broadly down front, but not attaining margin of eyes. Antennae with third joint shorter than fifth, fourth long. Prothorax barely twice as broad as long, slightly arcuate, sometimes feebly obtuse-angulate; surface alutaceous with scattered coarse punctures; spots moderately large and black. Scutellum black. Elytra rather finely but confluent punctate, with short fine pubescence; lateral and sutural vittae wide and black and usually not united at apex. Body beneath pale with narrow dark margin to metasternum and abdomen, in Montana specimens this margin becoming very wide and leaving only a narrow pale median line. Length, 6 mm. to 7 mm.; width, 2 mm. to 3 mm.

*Type*.—Collected by H. B. Hungerford, July, 1927, at Douglas Lake, Mich. U.S.N.M. No. 43017 (with 5 paratypes). Six paratypes deposited in collection of Kansas University.

*Distribution*.—Massachusetts; New York (Lake Placid); West Virginia; Michigan; Minnesota; North Dakota; South Dakota; Missouri; Montana; Washington; "Fort McLeod, British America."

*Food plant*.—Unknown.

*Remarks*.—This species has been confused with *virgata* and *convergens* in collections. It is smaller, more slender, and with finer elytral punctation than *virgata*. In fact, some specimens, probably because of the fine punctation, have been labeled *canadensis*, but it is quite distinct from *canadensis* in its smaller size and heavier markings and sparser elytral pubescence. It usually differs also from both *virgata* and *canadensis* in having a wide black band across the base of the head, curving broadly down over the front. It is more closely related to *convergens*, but is not so small or with so long pubescence, and lacks metallic luster in its dark markings. The pale vittae are usually wider than in *convergens* and extend to the apex. The western specimens from the Rocky Mountain region have a darker ventral surface than the eastern ones, which are almost entirely pale beneath. The aedeagus in *borealis* is not so heavy or so long as in *virgata*, and the tip is more acutely narrowed in contrast to the broader, blunter tip of *virgata*.

TRIRHABDA BOREALIS INDIGOPTERA, new variety

*Description*.—Larger (6 mm. to 8 mm. long, 2.5 mm. to 3.5 mm. wide); vittae usually deep blue or purplish, rarely green. Body beneath mostly pale.

*Type*.—Collected at Brookings, S. Dak. (Knab collection). U. S. N. M. No. 43018 (with 14 paratypes).

*Distribution*.—Illinois, Minnesota, North and South Dakota, Kansas.

*Remarks*.—The elytral vittae are so deep blue or purplish that unless they are examined closely or compared with specimens having black vittae, the bluish hue is not readily seen. This variety is about the same size as *virgata*, with which it has been confused in collections, although it is slightly more slender and has finer elytral punctation.

6. TRIRHABDA NEOSCOTIAE, new species

Plate 1, Figure 6

*Description*.—Small, subparallel, not shining, pale, with wide black occipital plaga, rather large pronotal spots, and very dark blue or bluish green (appearing nearly black) wide lateral and sutural vittae; ventral surface mostly dark. Head alutaceous with obsolete coarse punctures, finely and sparsely pubescent; a wide black occipital plaga extending across base of head and curving down front, but not attaining margin of eyes. Antennae with

third joint shorter than fifth. Prothorax scarcely twice as wide as long, with arcuate sides, surface alutaceous with scattered coarse punctures; spots usually large, especially the median one, and black. Scutellum entirely dark. Elytra coarsely punctate, with punctures confluent and shallow, not so coarse and distinct as in *virgata*; finely pubescent; a wide lateral vitta frequently uniting at apex with sutural vitta, the intervening pale vitta being in many cases extremely narrow but of approximately same width throughout its length, these dark vittae blue or green (often inconspicuously so), not lustrous. Body beneath pale with sides of metasternum and abdomen widely darkened. Length, 5.6 mm. to 6.5 mm.; width, 2.5 mm. to 3.2 mm.

*Type*.—Collected by C. A. Frost, July, 1929, Portau-pique, Nova Scotia. U.S.N.M. No. 43019 (with 7 paratypes). Ten paratypes in collection of C. A. Frost.

*Distribution*.—Nova Scotia (Castlereigh, Westchester, Portau-pique).

*Food plant*.—Goldenrod, *Solidago*.

*Remarks*.—The three species of the *convergens* group—*neoscotiae*, *convergens*, and *viridicyanea*—are all closely related, although easily separable by their elytral coloring and generally by their geographic range. They may all be varieties of a small northern species. I am unable to separate them by the shape of the aedeagus, which in all is very similar. LeConte treated the first of these (*neoscotiae*) as a form of *convergens*, in which the lateral and sutural vittae frequently are not united. The Nova Scotia specimens also are unlike typical *convergens* in coloring, having dark vittae without metallic luster, and often appearing nearly black. *T. neoscotiae* is not so densely pubescent as typical *convergens*, and the sutural and lateral vittae never coalesce so as to cover the elytra except for the pale margin, as is frequently the case in typical *convergens*. The ventral surface also is not so completely darkened.

#### 7. *TRIRHABDA CONVERGENS* LeConte

Plate 1, Figure 7

*Trirhabda convergens* LECONTE, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 220, 1865.

*Description*.—Small, subparallel, faintly shining with metallic luster, pale with a wide dark basal plaga across head, large black pronotal spots and elytra either entirely metallic green except for margin or with narrow pale vitta, usually wider at base and not reaching apex; ventral surface dark. Head alutaceous with obsolete rugose punctation; a wide dark plaga, often with green luster, over base of head, frequently reaching margin of eyes and some-

times a dark margin encircling eyes. Antennae with third and fifth joints subequal. Prothorax approximately twice as broad as long, with arcuate sides; surface alutaceous with scattered coarse punctures; spots large and black. Scutellum black. Elytra coarsely and confluent punctate, covered with long, dense, pale pubescence, entirely metallic green except for pale margin or with a median narrow pale vitta, wider at base and usually extending well down to apex, but not joining apical pale margin (in one specimen from Custer, S. Dak., the pale vitta reaches apex). Body beneath pale with metasternum and abdomen except for last ventral segment dark with green luster. Length, 5 mm. to 6.5 mm.; width, 2.3 mm. to 3 mm.

*Type locality*.—"Kansas, Nova Scotia" (the Nova Scotia specimens are here referred to *T. neoscotiae*).

*Distribution*.—Alberta (Waghorn, Blackfalds, Edmonton); Montana (Bear Paw Mountain, Beaver Creek); Wyoming (Yellowstone Park, Rock River); Colorado (Buena Vista, Pingree Park, Pagosa Springs, Creede, Colorado Springs); New Mexico (Fort Wingate, Pecos); South Dakota (Custer); Kansas (Douglas County); Michigan (Trout Lake).

*Food plant*.—Goldenrod, *Solidago* (F. S. Carr).

*Remarks*.—Compared with *T. neoscotiae*, specimens of this species are a little smaller, the vittae are decidedly green, with more metallic luster, the plaga over the head frequently and the ventral surface nearly always have a green luster, as is not the case with *neoscotiae*, and the entire elytra, except for the margin, are frequently green. The shape of the elytral vittae is somewhat different in that the pale vitta is usually wider near the base of the elytra, converging and becoming attenuated toward the apex. The third, fourth, and fifth antennal joints are usually somewhat different in length from the corresponding ones of *neoscotiae*, in which the fourth is considerably longer and the third not subequal to fifth.

Prof. T. D. A. Cockerell has named the variety without vittae *virescens*.<sup>9</sup>

#### 8. TRIRHABDA VIRIDICYANEA, new species

Plate 1, Figure 8

*Description*.—Small, parallel, coarsely punctate, pale with broad black occipital and pronotal spots; elytra except for margin usually bright blue green, occasionally with a pale median vitta, lightly pubescent; ventral surface more or less dark. Head alutaceous with punctures obsolete and confluent, moderately pubescent; a wide black occipital band, sometimes attaining margin of eyes, rarely

<sup>9</sup> *Trirhabda convergens virescens*, Ent. News, vol. 1, p. 4, 1890.

with a faint metallic luster. Prothorax twice as broad as long, with arcuate sides, alutaceous with scattered coarse punctures; spots moderately large, black. Scutellum entirely black. Elytra parallel, rather coarsely and confluent punctured, pubescent, and, except for pale margin, entirely shining blue green, or with a median pale vitta reaching apex. Body beneath with metasternum and abdomen usually dark except in middle and on the last ventral segment. Length, 5 mm. to 6 mm.; width, 2 mm. to 2.2 mm.

*Type*.—Collected at Winona, Wis., no collector given. Formerly in Brooklyn Museum collection. U. S. N. M. No. 43020 (with 3 paratypes).

*Distribution*.—Wisconsin (Winona); Ontario (Nepigon, Michipicoten); Manitoba (Aweme); Alberta (Medicine Hat).

*Food plant*.—Goldenrod, *Solidago* (F. S. Carr).

*Remarks*.—Although readily separable by its bright blue-green elytra from typical *convergens*, which is usually of a dull yellow-green, there are few structural characters by which to distinguish this from *convergens*. In collections it has frequently been labeled *flavolimbata*, and has apparently never been associated with *convergens*. It is quite unlike the California *flavolimbata*, not only in its small size and parallel shape, but also in the black coloring of the occipital and pronotal spots and ventral surface. The ventral surface in the paler, vittate specimens is pale with only a narrow darker margin, which is not typical of vittate *convergens*. It is also not quite so densely pubescent.

#### 9. *TRIRHABDA PILOSA*, new species

##### Plate 1, Figure 9

*Description*.—Small, subparallel, covered with moderately dense, white pubescence; head with wide, dark plaga, prothorax with large black spots, elytra entirely green except for pale margin and short median basal vitta not reaching middle, ventral surface mostly dark. Head densely covered with long, white pubescence over the wide black occipital plaga, this plaga often with metallic luster, and extending down front and about upper part of eyes. Antennae with third and fifth joints subequal. Prothorax approximately twice as broad as long, with slightly arcuate sides, very obtusely angulate at middle; surface alutaceous with coarse punctures, pubescent; spots large, black, sometimes in contact. Scutellum usually black, sometimes with pale tip. Elytra finely punctate, densely and finely pubescent; green except for margin and small pale median area between scutellum and humerus, this becoming attenuated and disappearing before middle. Body beneath pale with metasternum and



abdomen, except for last segment, dark with metallic luster and densely pubescent. Legs with outer edge darkened. Length, 4.5 mm. to 6.8 mm.; width, 1.8 mm. to 2.8 mm.

*Type*.—Collected by D. H. Blake, September, 1927, at Mammoth, Yellowstone Park, Wyo. U. S. N. M. No. 43021 (with 71 paratypes). Four paratypes each in collections of C. A. Frost, F. S. Carr, H. P. Löding, Museum of Comparative Zoology, Academy of Natural Sciences of Philadelphia, Illinois State Natural History Survey, and University of Kansas.

*Distribution*.—Wyoming, Nevada, California (Nevada County, Truckee, Tallac, Lake Tenaya, Yosemite).

*Food plant*.—Sagebrush, *Artemisia tridentata* Nuttall (D. H. Blake).

*Remarks*.—This small species somewhat resembles *attenuata* in elytral markings, and has been confused with it. It is smaller than *attenuata*, and the dense white pubescence of the prothorax, as well as the larger pronotal spots, at once differentiates it. The elytra are yellowish green rather than bluish green, as is more often the case in *attenuata*, and the median vitta rarely reaches the middle of the elytra, whereas in *attenuata* it attains the middle and not infrequently extends nearly to the apex. The ventral surface of *pilosa* is also much darker than in *attenuata*. Its range also is different, as it occurs from Wyoming to the Sierra Nevada in California, while *attenuata* is found from the Great Plains to the Rocky Mountains.

#### 10. TRIRHABDA ATTENUATA (Say)

Plate 1, Figure 10

*Galleruca attenuata* SAY, Journ. Acad. Nat. Sci. Philadelphia, vol. 3, p. 459, 1824.

*Trirhabda attenuata* LECONTE, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 220, 1865.

*Description*.—Elongate, finely punctate, lightly pubescent; pale yellow with wide black plaga over occiput, pronotum with usual three spots, elytra with wide blue or green lateral and sutural vittae coalescing usually at middle and leaving only an attenuated pale vitta, wider at base, on either elytron. Head rugosely punctate over occiput, moderately densely pubescent, a wide dark plaga with usually green luster across base of head curving down over front. Antennae with third joint shorter than fifth. Prothorax approximately twice as wide as long, with arcuate sides, shining, with scattered coarse punctures, surface sometimes lightly pubescent; spots small, median one situated nearer base than anterior margin. Scutellum frequently with paler outer margin. Elytra finely punc-

tate, moderately pubescent, surface somewhat shining. Vittae bright blue-green or blue, wide, usually coalescing at or behind middle, leaving a pale vitta wider at base and becoming attenuated toward apex, occasionally the pale vitta extending nearly to apex, but sutural and lateral vittae always united. Body beneath pale with metasternum and sides of abdomen dark with metallic luster, densely covered with white pubescence. Length, 5 mm. to 8 mm.; width, 2 mm. to 3.8 mm.

*Type locality*.—Collected by T. Nuttall "in Mississippi" (on the Mississippi?).

*Distribution*.—South Dakota (Black Hills, Dewey, Fall River County, Hat Creek); Nebraska (Hat Creek); Kansas (Cheyenne County); Montana (Poplar, Musselshell County, Meagher County, Huntley, Gallatin Mountains, Assiniboine, Glendive); Wyoming (Platte County); Colorado (Eckley, Morrison); Utah; Alberta (Medicine Hat); British Columbia.

*Food plants*.—Sagebrush, *Artemisia*, and goldenrod, *Solidago* (F. S. Carr).

*Remarks*.—Say's name *attenuata*, based on specimens "captured by Mr. Nuttall in Mississippi," was adopted by LeConte for this species, although Say's description of the elytra as polished does not fit either this or any other *Trirhabda*. The elytra are somewhat shining with metallic luster and are very finely punctate. The type locality, also, seems somewhat doubtful; I have seen no specimens taken east of the Dakotas, Nebraska, and Kansas. Possibly Nuttall collected it along the Mississippi or its branches.

#### 11. *TRIRHABDA LEWISII* Crotch

Plate 1, Figure 11

*Trihabda* (sic) *lewisii* CROTCH, Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 56, 1873.

*Trirhabda lewisii* HORN, Trans. Amer. Ent. Soc., vol. 20, p. 70, 1893.

*Description*.—Of moderate size, elongate, parallel, lightly punctate and pubescent; pale yellow with wide black plaga across occiput, moderate-sized black pronotal spots, elytra with moderately wide lateral and sutural vittae, green, blue, purple, or piceous, these vittae usually united at apex. Head alutaceous with obsolete, shallow, coarse punctures over occiput, lightly pubescent; a wide black plaga extending across base of head and curving widely over front. Antennae with third and fifth joints subequal. Prothorax fully twice as broad as long with arcuate sides, surface not shining, alutaceous with scattered coarse punctures; spots moderately large. Scutellum bicolored. Elytra lightly punctate, pubescence short and inconspicuous; a moderately wide lateral and sutural vitta, usually

uniting at apex, and with metallic luster, most frequently green, but often bluish or purplish or infrequently even piceous. Body beneath pale with darker margins to metasternum and abdomen. Length, 5 mm. to 7.5 mm.; width, 1.8 mm. to 3 mm.

*Type locality*.—New Mexico. Collected by Doctor Lewis.

*Distribution*.—Montana (Musselshell County); Wyoming (Yellowstone Park, Rock River); Colorado (Custer County, Paonia, Fort Collins, Grand Junction, Creede, Salida, Saguache, Durango, Garland, Colorado Springs, Colbran, Glenwood Springs, Buena Vista); Utah (Uinta National Forest, Beaver Range Mountains); New Mexico (Taos, Jemez Mountains).

*Food plant*.—*Chrysothamnus* of the *C. nauseosus* group (D. H. Blake).

*Remarks*.—Except for the size and coloring of the vittae, this species is subject to little variation. A series of specimens, however, from Creede, Colo. (University of Kansas collection), is very heavily marked, the occipital plaga extending to the eyes, the pronotal spots touching each other, and in some specimens the elytral vittae so wide as to coalesce and produce typical *convergens* or even *attenuata* markings. The scutellum is usually bicolored even in the darkest specimens. *T. nitidicollis* is larger and more robust than *lewisii* and does not have the wide basal plaga on the head or as large pronotal spots. The pronotum in *lewisii* is not polished as in *nitidicollis*, but the elytra resemble those of that species in being finely punctate although more lightly pubescent.

## 12. TRIRHABDA NITIDICOLLIS LeConte

### Plate 1, Figures 12, 12a

*Trirhabda nitidicollis* LECONTE, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 219, 1865.

*Description*.—Oblong, pale; prothorax shining, not depressed, with small spots; elytra usually with narrow vittae, sometimes piceous, frequently blue, green, or purple. Head finely alutaceous, sometimes with coarse punctation, lightly pubescent over occiput; occipital spot usually with metallic luster, sometimes piceous, wider at base and narrowing down front into a point. Antennae with third joint shorter than fifth. Prothorax large, barely twice as broad as long, obtusely angulate at middle of lateral margin; surface very polished, sometimes nearly impunctate; spots small, piceous, the median one tending to be diamond-shaped, occasionally evanescent. Scutellum bicolored, infrequently entirely pale. Elytra oblong with broad apex, finely and obsoletely punctate, finely pubescent; vittae generally narrow and united at apex, varying from piceous (in many New Mexico and Arizona specimens) to blue or

green (particularly well marked in Montana, Idaho, and some California specimens). Body beneath entirely pale. Length, 7 mm. to 9 mm.; width, 2.8 mm. to 3.8 mm.

*Type locality*.—New Mexico. Collected by Fendler.

*Distribution*.—Montana (Dillon); Idaho (Soda Springs); Wyoming (Yellowstone Park); Colorado (Sedalia, Canon City); Utah (Beaver Canyon); Nevada (Esmeralda); New Mexico (Lamy); Arizona (Bright Angel, Squaw Springs); California (Los Angeles County, Chino Canyon, Lebec, Bishop).

*Food plants*.—*Gutierrezia sarothrae* (Caudell), *Chrysothamnus* of the *C. nauseosus* group (D. H. Blake), sagebrush, *Artemisia* sp. (R. Hopping).

*Remarks*.—This species is distinguished by its large, polished, and not depressed prothorax. A series of specimens from Los Angeles County, Calif., collected by Coquillett, and a series from Esmeralda, Nev., present considerable variation. They are smaller (6 mm. to 8 mm.), with less well-defined vittae, which do not join at the apex; the pronotum is somewhat depressed and has scattered coarse punctures, contrasting with the polished, nearly impunctate surface of typical *nitidicollis*, and the spot on the head is larger.

### 13. *TRIRHABDA ERIODICTYONIS* Fall

Plate 1, Figure 13

*Trirhabda eriodictyonis* FALL, Can. Ent., vol. 39, p. 243, 1907.

*Description*.—Elongate, dull yellow-brown, head with a narrow occipital spot; prothorax 3-spotted, shining, angulate; elytra usually with darkened humeral spot or this occasionally extended into lateral vitta having a metallic luster. Head densely and moderately coarsely punctate, with pale light pubescence; a narrow, sometimes linear, black spot down vertex, broader in male. Antennae with third joint slightly shorter than fifth. Prothorax twice as broad as long, usually with prominent median angle on lateral margins; surface shining with only sparse coarse punctures; spots small and tending to be diamond-shaped. Scutellum pale, usually with narrow piceous margin at base. Elytra elongate, somewhat narrowed toward apex, densely and finely punctate, with fine, dense, short but not conspicuous pubescence. A dark humeral spot, sometimes extending into a narrow lateral vitta with greenish metallic luster. Body beneath entirely pale. Length, 5 mm. to 9 mm.; width, 1.8 mm. to 3.5 mm.

*Type locality*.—"Pasadena, San Bernardino, and elsewhere in southern California."

*Distribution*.—Utah (Washington County); California (Los Angeles County, Claremont, Cajon Pass, Mojave Desert, Pasadena, Mount Wilson, Chino Canyon).

*Food plant*.—*Eriodictyon* sp.

*Remarks*.—In this species the difference in size of the sexes is very apparent, the male being sometimes a third smaller than the female. The shining prothorax resembles that of *nitidicollis*, but it is usually more depressed and not so long. The elytral vittae are usually much less marked than in *nitidicollis*, there being in most specimens no evidence of sutural vitta beyond a slight darkening of the sutural edges. The aedeagus is short and rather blunt. Except for one specimen in the Casey collection labeled Washington County, Utah, I have seen specimens only from southern California.

#### 14. TRIRHABDA DIDUCTA Horn

Plate 1, Figure 14

*Trirhabda diducta* HORN, Trans. Amer. Ent. Soc., vol. 20, p. 70, 1893.

*Description*.—Elongate, subparallel, pale yellow-brown, with shining, 3-spotted prothorax; elytra with blue, green, or purple sutural and lateral vittae, usually also a narrow median vitta, not reaching base and uniting with lateral vitta toward apex. Head punctate over occiput and front, lightly pubescent, a moderately broad, black, oblong spot on occiput extending down front. Antennae with third joint slightly shorter than fifth. Prothorax approximately twice as broad as long, with arcuate sides, scarcely angulate; surface shining with scattered coarse punctures; spots black, moderate in size, often becoming small and diamond-shaped. Scutellum piceous, frequently with pale apex. Elytra finely and obsoletely punctate, pubescence fine, short, and dense; sutural and lateral vittae usually not wide, a narrow median vitta frequently arising before middle and uniting with lateral vitta before apex, this median vitta often faint and evanescent; lateral and sutural vittae usually uniting at apex, with blue, green, or purple luster. Body beneath pale with margin of metasternum and abdomen sometimes darkened. Length, 6.5 mm. to 9 mm.; width, 2.5 mm. to 4 mm.

*Type locality*.—"Western Nevada and adjacent regions of California."

*Distribution*.—Nevada; California (Mokelumne Hill, Tulare County, Mount Tamalpais, Santa Clara County, Fresno, Ahwahnee).

*Food plant*.—*Eriodictyon californicum* (Hooker and Arnott) Greene.

*Remarks.*—*T. diducta* and *T. eriodictyonis* are closely related structurally, although appearing very unlike in their extremes of coloration. The paler specimens of *diducta* are hard to distinguish from the darker specimens of *eriodictyonis*. Both have a broad shining prothorax, which in *eriodictyonis* is usually quite angulate, while in *diducta* it is arcuate or very obtusely angulate. A short, blunt-tipped aedeagus is common to both. Both occur on the same food plant, *Eriodictyon* (Hydrophyllaceae). I have found one other species, *T. flavolimbata*, in small numbers on *Eriodictyon*, although its preferred food plant is *Baccharis pilularis* De Candolle. *T. diducta* can be separated from *nitidicollis* not only by the peculiar short aedeagus but also by the oblong shape of the occipital spot and the less angulate prothorax with usually larger spots.

15. **TRIRHABDA LUTEOCINCTA** (LeConte)

Plate 2, Figure 15

*Galleruca luteocincta* LECONTE, Proc. Acad. Nat. Sci. Philadelphia, vol. 4, p. 88, 1858.

*Trirhabda luteocincta* LECONTE, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 220, 1865.

*Description.*—Large, elongate, robust, pale with dark metallic luster on upper portion of head, large shining dark spots with green luster on prothorax, and green, blue, or nearly black elytra, these infrequently vittate. Head rather finely but densely punctate and covered with long white pubescence over occiput; a wide, shining dark metallic plaga across base of head, curving down well over front, and frequently a spot on margin of eyes in front. Antennae with third joint shorter than fifth. Prothorax scarcely twice as broad as long, with obtusely angulate margins, and with scattered coarse punctures, occasionally a light pubescence more conspicuous on sides, very shining, 3-spotted, the spots very large and with metallic blue or green luster. Scutellum usually black, except in vittate specimens, then bicolored. Elytra shining, moderately coarsely punctate and with long, pale, silky pubescence, and, except for pale margin, usually dark green, blue, or violet, appearing nearly black, sometimes with a pale median vitta on each elytron extending well down and sometimes reaching apex. Body beneath with abdomen and sides of metasternum dark with metallic luster, outer edge of femora dark green. Length, 8.5 mm. to 10.5 mm.; width, 3 mm. to 4 mm.

*Type locality.*—"San Diego, also Santa Cruz, Calif."

*Distribution.*—California (Orange County, Los Angeles, Ventura, Santa Barbara County).

*Food plants*.—Sagebrush, *Artemisia* sp. (LeConte), *Aplopappus squarrosus* Hooker and Arnott (Blake), greasewood, *Covillea tridentata* (R. S. Vaile).

*Remarks*.—There is one dark specimen of this in the Bowditch collection labeled "Florida," and I have also examined four specimens from the Horn collection labeled "New Jersey." These are typical *luteocincta*, two being vittate and two with dark-blue elytra, appearing nearly black. I doubt the correctness of the labels, as the species is otherwise known only from the coast of middle and southern California. The aedeagus differs from that of most of the species in its extremely long and tapering tip, but agrees in this respect with two closely related California species, *labrata* and *confusa*.

16. TRIRHABDA CONFUSA, new species

Plate 2, Figure 16

*Description*.—Closely resembling *luteocincta* but smaller, with less heavily marked head and pronotum and paler ventral surface. Head moderately coarsely punctate, and with long but not dense pubescence, a broad dark occipital spot with metallic luster, usually not covering base of head, and curving down front often to an acute point, but rarely extending to eyes. Antennae with third joint shorter than fifth. Prothorax scarcely twice as wide as long, with obtusely angulate sides; surface shining, not greatly depressed, with few scattered punctures; spots small, usually piceous, sometimes with inconspicuous metallic luster, median one small, rounded or diamond-shaped. Scutellum usually bicolored. Elytra finely and densely punctate, with long silky pubescence, entirely blue or green except for pale margin or occasionally vittate with pale median vitta not reaching apex. Body beneath pale, frequently with dark metallic margin to metasternum and abdomen. Legs entirely pale or with only small darker spot on outer side of femora. Length, 7 mm. to 8.5 mm.; width, 2.8 mm. to 3.8 mm.

*Type*.—Collected by D. W. Coquillett in Los Angeles County, Calif. U.S.N.M. No. 43022 (with 2 paratypes).

*Distribution*.—California (San Gabriel, Los Angeles County, Bakersfield, Lebec, Bishop, Yreka).

*Food plant*.—Sagebrush, *Artemisia* sp. (R. Hopping).

*Remarks*.—The prothorax of this species suggests in its shining surface that of *nitidicollis*, but the long, dense, silky pubescence of the elytra as well as the differently shaped aedeagus separates it from that species. It is closely related to *luteocincta* and may be only a regional variety, although the aedeagus is not exactly similar, having a tapering tip, which is distinctly shorter and more pointed

than that of *luteocincta*. It is also smaller and of paler coloring. The pronotal spots are never very large and are usually piceous. It ranges farther inland and northward than *luteocincta*. *T. flavolimbata* is more oval, usually not so long and parallel in shape, and has more coarsely punctate, less pubescent elytra, and usually a wider occipital band.

17. *TRIRHABDA LABRATA* Fall

Plate 2, Figure 17

*Trirhabda labrata* FALL, Can. Ent., vol. 39, p. 242, 1907.

*Description*.—Medium sized, parallel, pale with brilliantly shining green or blue-green markings, a wide plaga over base of head, very large contingent spots on pronotum, and elytra, except for margin, unicolorous. Head obsoletely and confluent punctate, nearly smooth, and lightly pubescent, a shining wide green plaga across base of head, extending well down front and in some specimens encircling eyes, labrum dark. Antennae with third joint shorter than fifth. Prothorax barely twice as broad as long, with arcuate, sometimes obtusely angulate sides, very shining, with scattered coarse punctures; spots large, often touching and with metallic luster. Scutellum black. Elytra coarsely, densely, and rugosely punctate, with short, inconspicuous, and sparse pubescence, very shining and entirely green or blue-green except for narrow pale margin. Body beneath pale with metasternum and abdomen except for last segment dark metallic green; outer femora and tibiae and occasionally tarsi also dark. Length, 6 mm. to 7.5 mm.; width, 2 mm. to 3 mm.

*Type locality*.—Monterey, Calif.

*Distribution*.—California (Monterey, Guadalupe).

*Food plants*.—*Aplopappus ericoides* (Lessing) Hooker and Arnott (D. H. Blake), "*Biglovia* sp." (= *Aplopappus* sp.) (Blaisdell), chamiso, *Adenostoma fasciculatum* Hooker and Arnott (Coleman).

*Remarks*.—*T. labrata*, while very closely related to *luteocincta*, is a much more brilliant species on account of its very scant pubescence and its broader markings with lustrous green or blue-green metallic coloring. It is also slightly smaller than *luteocincta* and has more coarsely punctate elytra. The shape of the aedeagus is similar to that of *luteocincta*. No vittate form has been seen.

18. *TRIRHABDA SERICOTRACHYLA*, new species

Plate 2, Figure 18

*Description*.—Of similar shape and coloring to *T. luteocincta*, but smaller and with pubescent, closely and coarsely punctate prothorax, and paler ventral surface. Head densely and rugosely but not



coarsely punctate, and with dense pale pubescence over occiput; basal plaga wide, dark green with metallic luster, not usually encircling eyes. Antennae with third joint shorter than fifth. Prothorax barely twice as broad as long, with sides arcuate, sometimes very feebly angulate at middle; densely, coarsely punctate, usually with fairly dense pubescence; spots moderately large and usually lacking metallic luster. Scutellum black, frequently in paler (vittate) specimens with pale margin. Elytra covered with silky pubescence, hiding the fine, dense punctation; sometimes entirely shining blue or green with pale margin, sometimes with lateral, sutural, and often traces of median vittae, as in *diducta* (no specimens seen in which lateral and sutural vittae were not united at apex). Body beneath pale with only margin of metasternum and abdomen darker, a spot on outer femora also frequently dark metallic in color in darker specimens. Length, 6.8 mm. to 8 mm.; width, 2.8 mm. to 3.5 mm.

*Type*.—Collected at San Diego, Calif. U.S.N.M. No. 43023 (in Casey collection) (with 15 paratypes).

*Distribution*.—California (Los Angeles, Pasadena, Redondo, Santa Barbara County, Independence, Warners Hot Springs, Bishop, Red Bluff).

*Food plant*.—*Artemisia californica* Lessing.

*Remarks*.—This species has always been confounded with *luteocincta*, which it resembles in general shape and coloring. It differs from that species, however, in being somewhat smaller and in having a much more coarsely punctate and pubescent thorax, and in having a paler scutellum and ventral surface. The aedeagus is also utterly different in shape from that of *luteocincta*. The species ranges from the seacoast of southern California northward through the Sierras.

#### 19. TRIRHABDA FLAVOLIMBATA (Mannerheim)

##### Plate 2, Figure 19

*Galleruca flavolimbata* MANNERHEIM, Bull. Moscou, vol. 16, part. 2, p. 308, 1843.

*Trirhabda flavolimbata* LeCONTE, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 220, 1865.

*Description*.—Robust, of medium size, oblong (in females somewhat oval), pale with shining metallic-green or blue plaga across base of head, dark spots with metallic luster on pronotum, and elytra entirely blue or green except for pale margin. Head moderately coarsely punctate, lightly pubescent, a wide plaga with metallic luster over base of head curving down front, but not encircling eyes. Antennae with third joint shorter than fifth. Prothorax scarcely twice as broad as long, with sides feebly arcuate, not at all angulate, shining, with scattered coarse punctures; spots usually large and with inconspicuous metallic luster. Scutellum

dark, occasionally with paler margin. Elytra densely and rather coarsely and rugosely punctate and covered with moderately dense pubescence, entirely blue or green except for pale margin. Body beneath pale with metasternum and abdomen except for tip of last ventral segment dark shining green, legs with outer edge also darkened. Length, 5 mm. to 8 mm.; width, 2 mm. to 3.5 mm.

*Type locality*.—California.

*Distribution*.—California (Searsville Lake, near Stanford University; Marin County).

*Food plants*.—*Baccharis pilularis* De Candolle, also in small numbers on near-by *Eriodictyon* (D. H. Blake).

*Remarks*.—The pubescence on the elytra and the smaller, less metallic spots on the pronotum separate this species from *labrata*. The aedeagus, too, is quite distinct from the long tapering one of *labrata*. There is apparently no vittate form. One can not be entirely certain whether this or *labrata* is the true *flavolimbata* of Mannerheim, since the description fits either, and the type locality is only "California." *T. labrata* is recorded only from Monterey and Guadalupe, and since the headquarters of the expedition on which *flavolimbata* was collected were at San Francisco, in which region this species is known to occur, it is more probable that this species is the true *flavolimbata* of Mannerheim.

#### 20. *TRIRHABDA NIGROHUMERALIS* Schaeffer

##### Plate 2, Figure 20

*Trirhabda nigrohumeralis* SCHAEFFER, Brooklyn Inst. Mus. Sci. Bull., vol. 1, p. 170, 1905.

*Description*.—Small, elongate, somewhat more oval than usual in *Trirhabda*, dull pale brown with small occipital and pronotal spots and darkened humeri. Head moderately coarsely, shallowly, and densely punctate, with light pubescence; occipital spot usually small and oblong. Antennae with third and fifth joints subequal. Prothorax about twice as wide as long, with sides slightly arcuate, not at all angulate; surface alutaceous, somewhat pubescent, with scattered coarse punctures; spots small and black. Scutellum dark with pale tip. Elytra densely, not coarsely punctate, with short fine pubescence; pale brown with only the humeri darkened. Body beneath entirely pale. Length, 5 mm. to 7 mm.; width, 2 mm. to 3 mm.

*Type locality*.—Palmerlee, Cochise County, Ariz.

*Distribution*.—Arizona (Huachuca Mountains, Santa Rita Mountains, Prescott, Ashfork, Palmerlee, Bright Angel, Oracle); New Mexico (Las Vegas, Jemez Mountains).

*Food plant*.—*Brickellia* sp. (E. A. Schwarz).

*Remarks.*—The pale forms of *geminata* are sometimes difficult to distinguish from this species. In general, *nigrohumeralis* is smaller, and the punctation of the pronotum is not so coarse and dense. The aedeagus is quite unlike that of *geminata*, being small, tapering, and rounded at the tip.

#### 21. TRIRHABDA CADUCA Horn

##### Plate 2, Figure 21

*Trirhabda caduca* HORN, Trans. Amer. Ent. Soc., vol. 20, p. 69, 1893.

*Description.*—Oblong, coarsely punctate and moderately shining, yellow with broad black placa across base of head, three pronotal spots, and narrow reddish-brown sutural and lateral vittae, the latter evanescent in part. Head rather coarsely punctate; a broad black band extending nearly across base of head and down vertex. Antennae with third joint a little shorter than fifth. Prothorax twice as wide as long with arcuate sides; surface shining, sparsely and coarsely punctate, with the usual three spots. Scutellum either entirely piceous or bordered with yellow, not pubescent. Elytra oblong, coarsely but only moderately densely punctate, shining, very indistinctly pubescent; sutural edges darkened, lateral vittae very narrow and often evanescent and interrupted. Body beneath entirely pale. Length, 5.5 mm. to 6.5 mm.

*Type locality.*—Owens Valley, Calif.

*Distribution.*—Owens Valley, Calif.

*Remarks.*—This species is one of the rarest in collections, and I have seen only the original specimens of Horn. It is a very distinct species and unusual in its nearly glabrous, coarsely punctate elytra and short, oblong shape. It differs from *eriodictyonis* in its wider head markings and sparser, coarser punctation, as well as in its lack of pubescence and in the character of the elytral vittae. The lateral vittae appear farther from the margin than those of *eriodictyonis* and are plainly visible when viewed from above. It differs from *geminata* and *nigrohumeralis* also in its lack of pubescence, coarser punctation, and shining surface and in the nature of the vittate markings.

#### 22. TRIRHABDA GEMINATA Horn

##### Plate 2, Figure 22

*Trirhabda geminata* HORN, Trans. Amer. Ent. Soc., vol. 20, p. 68, 1893.

*Description.*—Medium sized, rather coarsely punctate, sometimes pale brown with only faint traces of reddish-brown vittae, sometimes with distinctly marked lateral, sutural, and median vittae, these vittae occasionally coalescing to produce nearly piceous elytra. Head alutaceous with coarse obsolete punctation, moderately pubes-

cent; in darker specimens frequently with black occipital spot extending across head, about eyes, and down front, in paler specimens this plaga reduced to a spot. Labrum usually piceous. Antennae with third joint slightly shorter than fifth. Prothorax not twice as broad as long, with slightly arcuate sides, without angles; surface alutaceous, densely and coarsely punctate, sometimes lightly pubescent; spots black, of moderate size. Scutellum frequently bicolored in paler specimens. Elytra densely and moderately coarsely but shallowly and confluent punctate, with fine short pubescence; in pale specimens with only traces of pale reddish-brown vittae; in better marked ones with a wide reddish-brown sutural vitta and lateral vitta and more feebly defined median one, not reaching base, and uniting with lateral and sutural vittae near apex; in dark specimens elytra almost entirely piceous. Body beneath unusually pale brown, deepening to reddish brown in dark specimens.

Length, 5.5 mm. to 7 mm.; width, 2.8 mm. to 3.5 mm.

*Type locality*.—"Occurs at San Diego, California, and Arizona."

*Distribution*.—Arizona (Tucson, Catalina Springs, northeast of Tucson; Prescott, Nogales, Santa Rita Mountains), California (San Diego, Claremont, Los Angeles, Idylwild).

*Food plant*.—*Encelia farinosa* Gray (E. A. Schwarz), *Bahia* sp.

*Remarks*.—Specimens from southern California near the coast are darker in their markings than many of the inland specimens. One from Idylwild, Calif. (collection of Kansas University), has elytral markings similar to those of *canadensis*, with no trace of a median vitta, although the others of the same series are typically colored dark specimens.

#### DEROSPIDEA, new genus

Oblong, subparallel, robust. Head glabrous, vertical, a median line over occiput and front; antennae with fourth joint longer than third, third and fifth subequal. Prothorax considerably more than twice as broad as long, depressed, lateral margins arcuate, tending to be obtusely angulate at middle. Scutellum truncate. Elytra oblong, pubescent, indistinctly margined, epipleura becoming indistinct behind middle. Tibiae feebly grooved for less than their entire length, first tarsal joint longer than second, claws bifid. Aedeagus short, with broad truncate tip.

*Type of genus*.—*Trirhabda brevicollis* LeConte.

This genus is distinguished from *Trirhabda* by the prothorax, which in *Trirhabda* is approximately twice as broad as long; by the aedeagus, which is short and broad and without a pointed tip, and at its base has a wider and thickened chitinous band with distinct free tips on the ventral side; and by the pattern of coloration and pubescence. In *Trirhabda* there is always a well-marked occipital spot and the occiput is always pubescent, usually conspicuously so.

In *Derospidea* the occipital spot may be present or absent, and the head is glabrous. The three pronotal spots in *Trirhabda* are always present; in *Derospidea* they are evident in one species, vestigial or absent in two other species. When present, the median spot in *Derospidea* tends to be Y-shaped. The elytra are only feebly margined and are rounder and less parallel-sided than in *Trirhabda*.

*Derospidea* is separated from *Monocesta* by having the fourth antennal joint longer than the third and by the shape of the aedeagus. The genus *Monocesta* as described by Clark was divided into two subgroups, the first with the elytra postmedially dilated and the second with the elytra more parallel. Weise has designated as the type of the genus the first species of the first group (*Monocesta imperialis* Clark). *Monocesta cyaneomaculata* Jacoby, which I place in the genus *Derospidea*, was probably considered to belong in the second group of *Monocesta*, although the length of the antennal joints should have excluded it. The aedeagus of *Monocesta coryli* (pl. 2, fig. 27), the common United States species with postmedially dilated elytra, is quite unlike that of *Trirhabda* or *Derospidea*, being short and very broad with a short tip.

#### 1. *DEROSPIDEA BREVICOLLIS* (LeConte)

##### Plate 2, Figure 23

*Trirhabda brevicollis* LECONTE, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 221, 1865.

*Description*.—Robust, oblong, with very short prothorax, dull pale yellow with reddish-brown darkening of antennae and tarsi, dark occipital spot and three often indistinct pronotal spots; elytra with wide reddish-brown sutural and lateral vittae, usually united at apex. Head pale, occiput shining, impunctate, glabrous, with coarse, shallow punctures about vertical fovea on front and between eyes, a more or less evanescent reddish-brown spot on occiput extending down vertex. Antennae with third and fifth joints subequal. Prothorax considerably over twice as broad as long, with very arcuate sides, often obtusely angulate at middle; median spot Y-shaped, spots frequently evanescent; surface dimly alutaceous, with often rather dense coarse punctures. Scutellum usually bicolored, apex darkened by sutural vitta. Elytra oblong with feeble margin, densely punctate throughout, more coarsely so at base, with fine short pubescence; reddish-brown sutural vitta widest at base, but scarcely attaining base of elytra and tapering to apex, at apex uniting with wide lateral vitta, margin and epipleura often entirely darkened. Body beneath pale with tibiae and tarsi darkened. Length, 6.5 mm. to 9.5 mm.; width, 3 mm. to 4.5 mm.

*Type locality*.—"Abundant in Southern States, near sea coast, one specimen from Kansas."

*Distribution*.—Michigan; Illinois (Edgebrook); Indiana (De Kalb County); Iowa (Ames); Kansas; Texas; Louisiana (Baton Rouge); Mississippi; Alabama (Mobile); Florida; South Carolina.

*Food plant*.—Prickly-ash, *Zanthoxylum*; orange, *Citrus aurantium*.

*Remarks*.—This species has always been considered of the genus *Trirhabda*, although its specific name called attention to its unusual thoracic shape. LeConte placed it at the end of his species, remarking that it was easily known by its very short thorax. Other characters unite to make it unlike the other species of *Trirhabda*, and chief among them the unusual structure of the aedeagus. The species is not found on composites, but breeds on *Zanthoxylum*, and occasionally is a pest to orange, both of the Rutaceae. The larval habits described in the introduction are also unusual as far as is known in the genus *Trirhabda*.

## 2. DEROSPIDEA ORNATA (Schaeffer)

### Plate 2, Figure 24

*Trirhabda ornata* SCHAEFFER, Brooklyn Inst. Mus. Sci. Bull., vol. 1, no. 6, p. 137, 1905.

*Description*.—Oblong, dull, pale yellow, head without occipital spot, pronotum with very indistinct indication of four spots, elytra with wide basal violet fascia, uniting with sutural vitta, a wide lateral spot from middle nearly to apex, attaining lateral margin. Head somewhat wrinkled on front, occiput glabrous without dark spot. Antennae with third and fifth joints equal. Prothorax fully two and a half times as broad as long, with obtusely angulate sides; surface densely and coarsely punctate, pale with faint indications of four spots, two lateral, two smaller ones near middle anteriorly. Scutellum entirely pale. Elytra coarsely and densely punctate and covered with dense short pubescence; pale with wide, violet-colored, basal band, uniting with sutural vitta, a wide lateral spot extending to margin but not reaching apex or suture. Body beneath entirely pale, the femora, tibiae, and tarsi darker. Length, 8 mm.; width, 3.5 mm.

*Type locality*.—Esperanza Ranch, Brownsville, Tex.

*Food plant*.—Unknown.

*Remarks*.—This species is very closely related to the Mexican *Monocesta cyancomaculata*, which also belongs to the genus *Derospidea*, and until a larger series of both can be examined, their specific distinctness must remain in doubt. The only specimen of *cyancomaculata* I have seen has a broader prothorax, and the elytral spots are not so large, although similarly placed. The sculpture and pubescence are similar, however.

I have not dissected *Derospidea ornata*, as only the type specimen is known, but H. S. Barber kindly dissected for me the single specimen of *cyaneomaculata* in the United States National Museum collection. The aedeagus is strikingly like that of *brevicollis* in shape. All three species are similar in having glabrous heads and in the shape of the markings on the pronotum. The faint pronotal spotting of *ornata*, overlooked by Schaeffer, resembles that of the more weakly marked specimens of *brevicollis*, particularly in the traces of the Y-shaped median spot.

1. CORAIA SUBCYANESCENS (Schaeffer)

Plate 2, Figure 26

*Trirhabda subcyanescens* SCHAEFFER, Brooklyn Inst. Mus. Sci. Bull., vol 1, no. 9, p. 241, 1906.

*Description*.—Stout, parallel, coarsely punctate, not shining, light rufous with wide metallic-green spot on occiput, prothorax with three large piceous spots, elytra deeper reddish with variable green metallic luster, sometimes confined to humeri, scutellar region, and suture, sometimes over entire elytra. Head slightly produced frontally by dark tubercles above base of antennae; coarsely and rugosely punctate, with thick pubescence; a wide oblong dark spot over occiput and down front, with greenish luster. Antennae robust and dark, longer and stouter in male, and in both sexes having the basal, third, and fourth joints subequal. Prothorax not quite so broad as long, subquadrate, with nearly straight sides, as viewed from above; alutaceous with dense, almost rugose punctures over greater part, and densely pubescent; three large black spots, the lateral ones covering margin. Scutellum, sometimes entirely pale, again darkened apically. Elytra densely and coarsely punctate and moderately pubescent, reddish with green luster, sometimes more marked on humeri, about scutellar region and suture, and sometimes evenly distributed over elytra. Body beneath reddish with sides of metasternum, a spot on femora, and tibiae and tarsi dark. Outside edge of tibiae conspicuously smooth, shining, and ridged in basal portion with sulci on either side of the ridge. Length, 7.5 mm. to 8 mm.; width, 3.8 mm.

*Type locality*.—Brownsville, Cameron County, Tex.

*Distribution*.—Texas (Edinburg, Harlingen, and Brownsville).

*Food plant*.—Unknown.

*Remarks*.—Clark differentiated this genus from related genera by its subquadrate thorax, its long robust antennae, the third and fourth joints of which are equal, and its parallel body. It is stouter and more heavily chitinized than *Trirhabda*, and the head is slightly produced frontally. The difference in the antennae in the two sexes is also peculiar to this in contrast with related genera. The shape

of the aedeagus is more like that of *Monocesta*. Clark described only one species, *maculicollis*, and his description, except for the larger size, applies perfectly to *subcyanescens*. In the United States National Museum collection are several specimens of *Coraia*, one of which is undoubtedly *maculicollis*. The others are all smaller, and the Texas ones smallest of all, but all of them are very similar in shape, coloring, and sculpture. It may be that *subcyanescens* is merely a dwarfed northern form of *maculicollis*, but the question can not be settled until a larger series of specimens can be compared. *C. subcyanescens* has been collected only at the very southern tip of Texas. Two other Mexican species, quite distinct from this or *maculicollis*, have been described by Jacoby—*apicornis*, with a 7-spotted pronotum, and *clarki*, with very sparsely punctate pronotum.

## EXPLANATION OF PLATES

Beetles enlarged about three times; aedeagi, about eight times

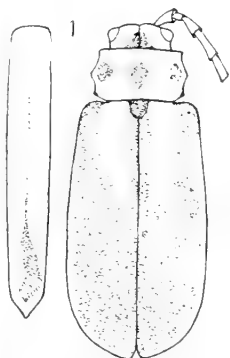
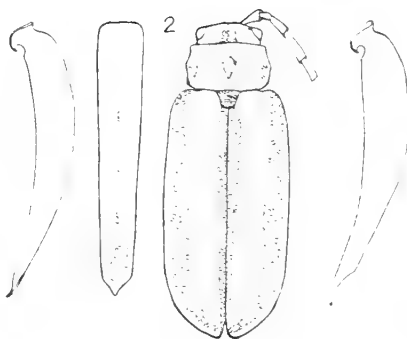
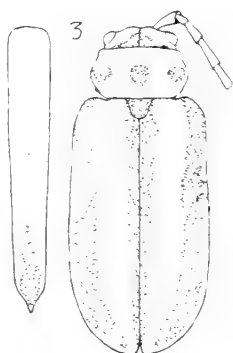
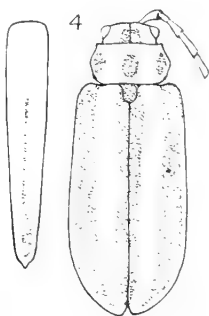
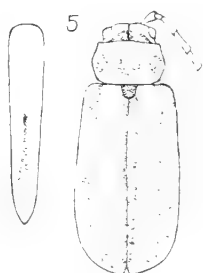
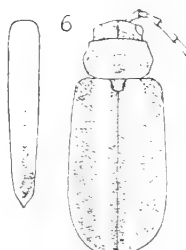
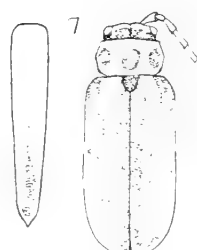
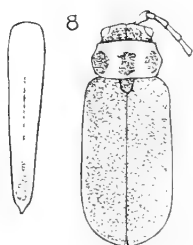
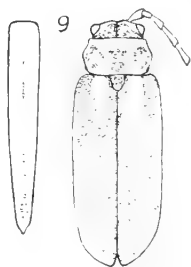
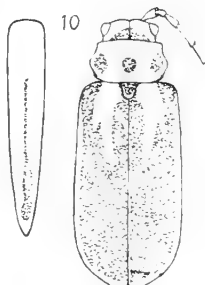
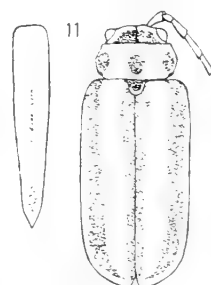
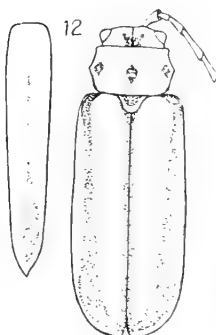
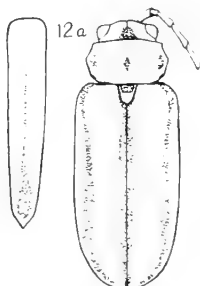
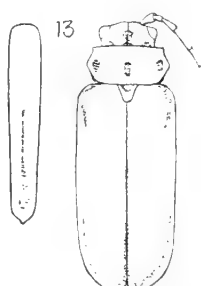
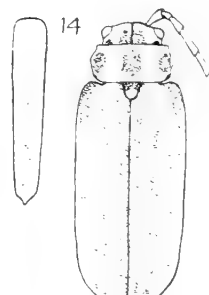
## PLATE 1

- Figure 1. *Trirhabda bacharidis* (Weber).  
2. *Trirhabda canadensis* (Kirby).  
3. *Trirhabda adela* Blake.  
4. *Trirhabda virgata* LeConte.  
5. *Trirhabda borealis* Blake.  
6. *Trirhabda neoscotiae* Blake.  
7. *Trirhabda convergens* LeConte.  
8. *Trirhabda viridicyanea* Blake.  
9. *Trirhabda pilosa* Blake.  
10. *Trirhabda attenuata* (Say).  
11. *Trirhabda lewisii* Crotch.  
12. *Trirhabda nitidicollis* LeConte.  
12a. *Trirhabda nitidicollis* var. LeConte.  
13. *Trirhabda eriodictyonis* Fall.  
14. *Trirhabda diducta* Horn.

## PLATE 2

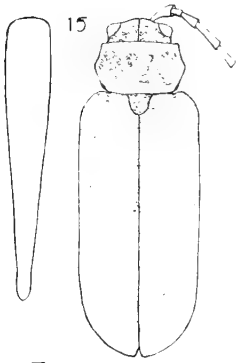
15. *Trirhabda luteocincta* (LeConte).  
16. *Trirhabda confusa* Blake.  
17. *Trirhabda labrata* Fall.  
18. *Trirhabda sericotrachyla* Blake.  
19. *Trirhabda flavolimbata* (Mannerheim).  
20. *Trirhabda nigrohumeralis* Schaeffer.  
21. *Trirhabda caduca* Horn.  
22. *Trirhabda geminata* Horn.  
23. *Derospidea brevicollis* (LeConte).  
24. *Derospidea ornata* (Schaeffer).  
25. *Derospidea cyaneomaculata* (Jacoby).  
26. *Coraia subcyanescens* (Schaeffer).  
27. *Monocesta coryli* (Say).



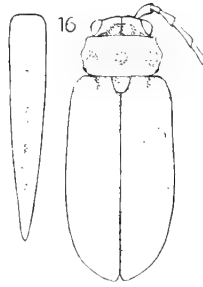
*Trirhabda bachanidis**T. canadensis**T. adela**T. virgata**T. borealis**T. neoscotiae**T. convergens**T. viridicyanea**T. pilosa**T. attenuata**T. lewisii**T. nitidicollis**T. nitidicollis* var.*T. eriodictyonis**T. diducta*

## SPECIES OF TRIRHABDA

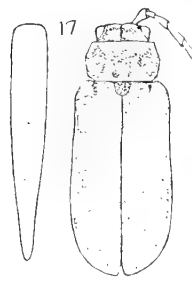
FOR EXPLANATION OF PLATE SEE PAGE 36.



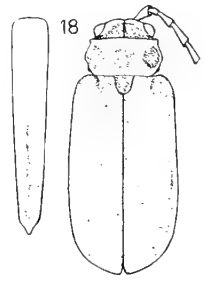
*Trirhabda luteocincta*



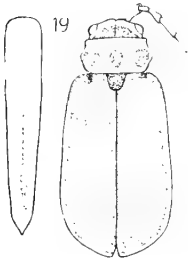
*T. confusa*



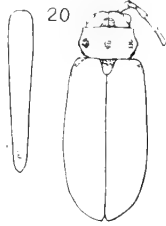
*T. labrata*



*T. sericeotrachyla*



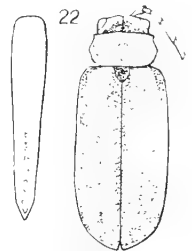
*T. flavolimbata*



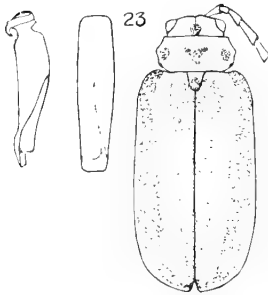
*T. nigrohumeralis*



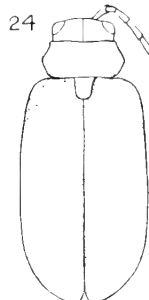
*T. caduca*



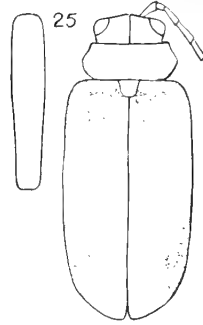
*T. geminata*



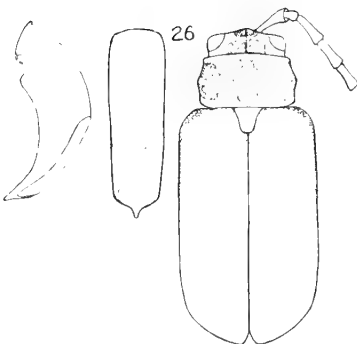
*Derospidea brevicollis*



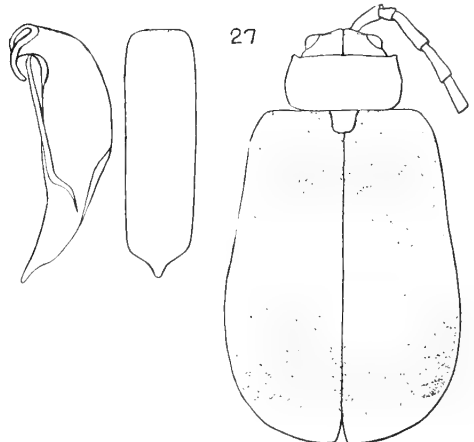
*D. ornata*



*D. cyaneomaculata*



*Coraia subcyanescens*



*Monocesta corydi*

SPECIES OF TRIRHABDA, DEROSPIDEA, CORAIA, AND MONOCESTA

FOR EXPLANATION OF PLATE SEE PAGE 36.

# A NEW SPECIES OF NEMATODE WORM FROM THE SAGE GROUSE

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On October 18, 1929, three sage grouse (*Centrocercus urophasianus*) were killed on the United States Range Livestock Experiment Station, Miles City, Mont. On post-mortem examination two large red nematodes were found coiled underneath the horny lining of the gizzard of one of the birds. On October 26, there were found in the gizzard of another sage grouse killed on Moon Creek, a near-by tributary of the Yellowstone River, 108 additional specimens of this same nematode. This is the first record, so far as the writer knows, of the collecting of a nematode belonging to the genus *Habronema* from the gizzard of a sage grouse.

## HABRONEMA UROPHASIANA, new species

### *Specific diagnosis.*—*Habronema*:

*Male*.—14.5 millimeters long by  $324\mu$  wide. The cuticle over the entire body is distinctly cross-striated. The head (figs. 1 and 3) is provided with four lips, two large laterals, a dorsal, and a ventral. Each of the lateral lips is divided externally into three lobes, each lobe bearing a more or less distinct tooth on its inner surface. Slightly external to the row of teeth there appears to be a horizontal row of two or three small papillæ. The dorsal and ventral lips have keel-like projections. The lateral ala is 4.16 millimeters long. It arises about  $277\mu$  from the anterior extremity of the body. The cervical papillæ, which are indistinct except under high magnification, are a short distance anterior to the ala, about  $245\mu$  from the head end. The narrow chitinated pharynx is  $50\mu$  long. The esophagus is 3.02 millimeters long and is surrounded by the nerve ring  $367\mu$  from the anterior extremity of the body. The caudal extremity is coiled spirally. The caudal alæ are broad; they are supported by eight pairs of pedunculated papillæ and bear four or five pairs of sessile papillæ (fig. 2) arranged as follows: Four pairs of preanal, two pairs of adanal, and two pairs of postanal pedunculated papillæ, and four or five pairs of small sessile ventral papillæ at the caudal

extremity. The spicules are unequal, 1.1 millimeters and  $410\mu$  long, respectively. Accessory piece present.

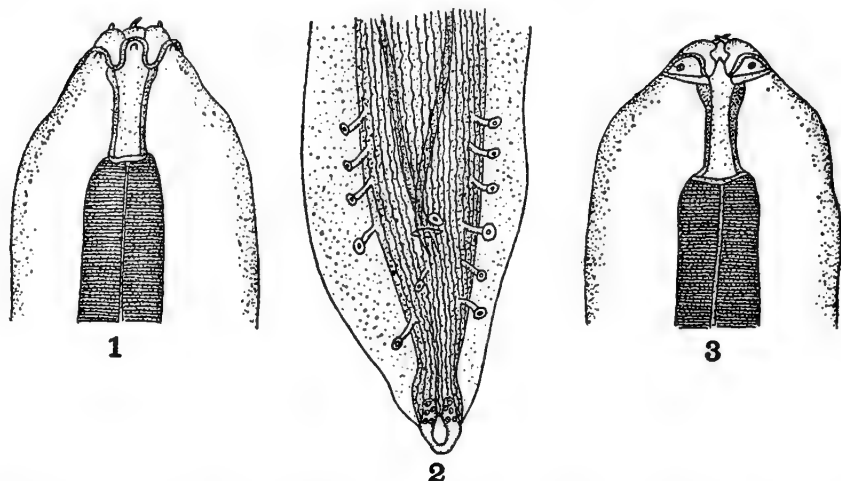
*Female*.—23.5 millimeters long by  $438\mu$  wide. The ala is 4.81 millimeters long. The vulva is distinctly visible and is situated anterior to the middle of the body, 10.58 millimeters from the head end. The ovejector is  $324\mu$  long and claviform. The nerve ring surrounds the esophagus at a point  $394\mu$  from the tip of the head. The pharynx is  $72\mu$  long; the esophagus 3.28 millimeters long. The tail is  $148\mu$  long. Eggs are 37 to  $42.5\mu$  long by 25.5 to  $27\mu$  wide.

*Host*.—*Centrocercus urophasianus*.

*Location*.—Gizzard.

*Distribution*.—United States (Moon Creek, Mont.)

*Type specimens*.—U. S. N. M. No. 29766; paratypes No. 29767.



FIGURES 1-3.—HABRONEMA UROPHASIANA. MALE. 1, HEAD, LATERAL VIEW; 2, TAIL VENTRAL VIEW; 3, HEAD, DORSAL VIEW. ORIGINAL

This species differs from *H. colaptes* in the number and position of the caudal papillæ of the male, in the position and extent of the lateral ala, and in the head structure; from *H. uncinipenis* by having cervical papillæ, and by having shorter spicules; from *H. pileata* by being larger in size, in the presence of cervical papillæ, and by having armed lateral lips; from *H. longispicula* by having shorter spicules.

KEY TO NORTH AMERICAN SPECIES OF HABRONEMA IN BIRDS

- |   |                                  |
|---|----------------------------------|
| 1. One lateral ala present.....   | 2                                |
| Two lateral alæ present.....  | 4                                |
| 2. Lateral lips unarmed; male more than 14 millimeters long.....                | 3                                |
| Lateral lips armed; male less than 14 millimeters long.....                     | <i>pileata</i>                   |
| 3. Left spicule 2.4 to 3.3 millimeters long; cervical papillæ not observed..... | <i>uncinipenis</i>               |
| Left spicule 1.1 millimeters long; cervical papillæ present.....                | <i>urophasiana</i> , new species |
| 4. Lateral alæ unequal; margin crenulated.....                                  | <i>incerta</i>                   |
| Lateral alæ equal; left spicule 3.24 millimeters long.....                      | <i>longispicula</i>              |

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YORKE, WARRINGTON, and MAPLESTONE, P. A.

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# FOUR NEW SPECIES OF TREMATODE WORMS FROM THE MUSKRAT, *ONDATRA ZIBETHICA*, WITH A KEY TO THE TREMATODE PARASITES OF THE MUSKRAT

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United States Department of Agriculture*

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This paper contains descriptions of four apparently new species of trematodes from the American muskrat, *Ondatra zibethica*. These parasites belong to four families, representatives of two of which have not been reported previously from this host. For convenience in identifying trematodes which have been reported from the muskrat, a key to the species is appended.

## Family PSILOSTOMIDAE Odhner, 1913

### PSILOSTOMUM ONDATRAE, new species

#### Figure 1

*Specific diagnosis.*—*Psilostomum*: Body ovoid, 1.6 to 2 mm. long by  $315\mu$  to  $961\mu$  wide in the region of the anterior testis, flattened dorsoventrally. Cuticular spines were not found on specimens from the muskrat, but in view of the fact that the specimens showed some evidence of maceration, it is probable that they had become detached before fixation; specimens of what appear to be the same species from *Larus californicus* showed spines distributed over the entire body in alternate transverse rows. Oral sucker subterminal,  $150\mu$  to  $155\mu$  in diameter; oral aperture slitlike to oval in shape. Acetabulum transversely elongated to almost circular in shape, strongly muscular,  $220\mu$  to  $300\mu$  by  $300\mu$  to  $375\mu$ , situated  $525\mu$  to  $537\mu$  from the anterior end of the body. Prepharynx  $38\mu$  to  $75\mu$  long, the length depending on the amount of contraction of the anterior part of the body. Pharynx strongly muscular,  $112\mu$  to  $127\mu$  long by  $82\mu$  to  $105\mu$  wide. Esophagus slender,  $75\mu$  to  $112\mu$  long; intestinal ceca simple, extending to within a short distance of the posterior end of the body. The excretory system can not be followed with certainty

owing to the maturity of the specimens, but so far as can be ascertained from the examination of serial sections, it appears to correspond closely to that given by Odhner (1913) in his diagnosis of the genus; excretory pore terminal. Testes large, elongated transversely, postequatorial, and tandem in position. The anterior testis is  $262\mu$  to  $375\mu$  long by  $412\mu$  to  $712\mu$  wide and the posterior testis  $262\mu$  to  $275\mu$  long by  $337\mu$  to  $750\mu$  wide. Cirrus pouch piriform, its posterior end never extending beyond the center of the acetabulum; it contains a voluminous seminal vesicle and a long, slender, unarmed cirrus. The genital pore is situated in the median line about midway between the bifurcation of the intestine and the anterior margin of the acetabulum. Ovary ovoid,  $75\mu$  by  $150\mu$ , situated a short distance in front of the anterior testis and to the left of the median line.

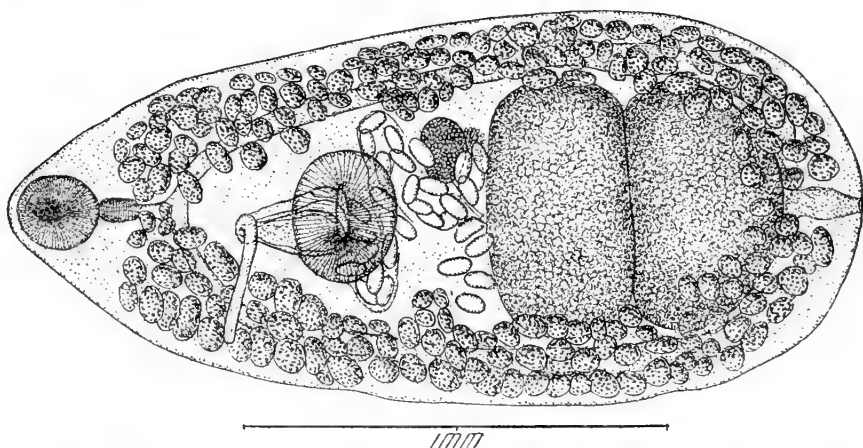


FIGURE 1.—*PSILOSTOMUM ONDATRAE*. VENTRAL VIEW OF SPECIMEN FROM MUSKRAT

Shell gland well developed, dorsad of ovary. Laurer's canal present. Receptaculum seminis apparently absent. The vitellaria are composed of large follicles situated laterally and forming a wreath-like mass extending from the level of the pharynx to the posterior end of the body. Uterus relatively short, consisting of irregular coils occupying the intercecal space between the anterior margin of the anterior testis and the acetabulum, and terminating in a moderately developed metraterm. The metraterm extends along the left side of the cirrus pouch and opens into the genital sinus immediately anterior to the male aperture. Eggs oval,  $82\mu$  to  $90\mu$  long by  $45\mu$  to  $48\mu$  wide, yellowish brown in color.

*Hosts*.—*Ondatra zibethica* and *Larus californicus*.

*Location*.—Liver of muskrat (according to label); proventriculus of gull.

*Distribution*.—Kirkfield, Ontario, and Klamath Falls, Oreg.

*Type specimens*.—U.S.N.M. Helm. Coll. No. 29749; paratypes No. 29750.



The above description is based entirely upon specimens collected from a muskrat and forwarded to the Zoological Division of the Bureau of Animal Industry for identification by Dr. Ronald G. Law, Experimental Fur Farm, Kirkfield, Ontario, on August 3, 1928. Specimens of what appear to be this form (U.S.N.M. No. 29221) were collected from a California gull (*Larus californicus*) by Dr. E. B. Cram, August 8, 1929, at Klamath Falls, Oreg. The specimens from the gull were located in the glands of the proventriculus, but aside from a slightly more cylindrical shape they appear to be specifically identical with the form from the muskrat. The slight difference in shape may be accounted for in part by the location of the worms in their respective hosts and in part by the methods employed in the fixation of the two lots of specimens. All essential measurements of the specimens from the gull intergrade with those of specimens from the muskrat to such an extent that it is unlikely that they represent separate species. The only species of the genus which resembles *Psilostomum ondatrae* sufficiently to warrant comparison is *P. varium*, a species described by Linton (1928) from the loon, *Gavia immer*. *P. ondatrae* may be differentiated from *P. varium* on the size and position of the testes, extent of the vitellaria, and on the position of the genital pore. In *P. varium* the testes are smaller and situated more anteriorly than in *P. ondatrae*; the vitellaria are distinctly separated in the preacetabular portion of the body in the former species, while in the latter these glands meet in the median line immediately caudad of the pharynx; the genital pore is located at the intestinal bifurcation in *P. varium* and about midway between the anterior margin of the acetabulum and the intestinal bifurcation in *P. ondatrae*.

### Family ECHINOSTOMIDAE Looss, 1902

### Subfamily ECHINOCHASMINAE Odhner, 1910

#### ECHINOCHASMUS SCHWARTZI, new species

#### Figure 2

*Specific diagnosis.*—*Echinochasmus*: Body spindle-shaped in outline, 1.5 to 2.1 mm. long by  $449\mu$  to  $620\mu$  wide in the region of the anterior testis. Cuticular spines are present in the anterior part of the body. These spines are scalelike and arranged in alternating, transverse rows; the rows anterior to the acetabulum are close together, while posterior to the acetabulum the rows are progressively farther apart and the number of spines decreases; spines finally disappear near the level of the posterior margin of the posterior testis. In specimens from the muskrat most of the cuticular spines were missing owing to the fact that the worms had been dead for several hours

before fixation. Oral sucker subterminal,  $93\mu$  wide, surrounded by a well-defined reniform collar,  $248\mu$  to  $279\mu$  wide. The collar bears 22 spines arranged in a single row which is interrupted dorsally by a space as wide as the oral sucker. Four of these spines, two on each ventral lobe, are slightly more aboral than the others; the more median of these spines is  $37\mu$  to  $41\mu$  long by  $11\mu$  wide at the base, while the others are from  $44\mu$  to  $51\mu$  long by  $11\mu$  to  $15\mu$  wide at their bases. Acetabulum circular,  $170\mu$  to  $186\mu$  in diameter, situated  $542\mu$  to  $775\mu$  from the anterior end of the body. Prepharynx  $46\mu$  to  $93\mu$  long, the length depending on the amount of contraction of the anterior part of the body. Pharynx muscular,  $108\mu$  to  $155\mu$  long by  $93\mu$  to  $108\mu$  wide. Esophagus  $124\mu$  to  $248\mu$  long; intestinal ceca simple and extending to near the posterior end of the body. Genital pore situated immediately caudad of intestinal bifurcation. Cirrus pouch poorly developed, somewhat piriform in shape, extending caudad to

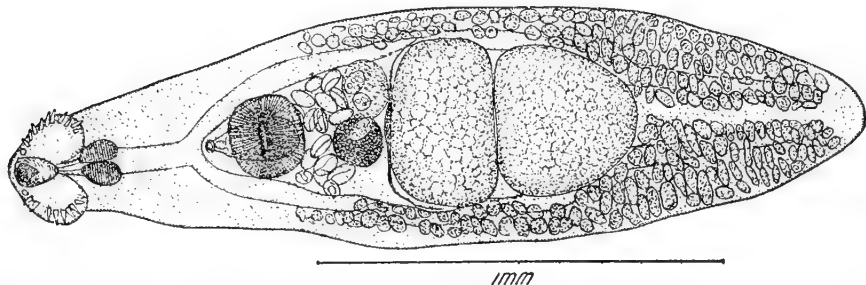


FIGURE 2.—ECHINOCHASMUS SCHWARTZI. VENTRAL VIEW OF SPECIMEN FROM MUSKRAT

near the posterior margin of the acetabulum, and containing a large seminal vesicle showing a distinct constriction near its anterior end, a poorly defined prostate, and a short ductus ejaculatorius. Testes largely postequatorial and tandem in position; the anterior testis is almost rectangular in shape,  $155\mu$  to  $279\mu$  long by  $310\mu$  to  $434\mu$  wide; the posterior testis is irregular to almost spherical in outline,  $186\mu$  to  $310\mu$  long by  $263\mu$  to  $372\mu$  wide. Ovary ovoid,  $108\mu$  to  $124\mu$  by  $124\mu$  to  $170\mu$ , situated slightly to the right of the median line and with its long axis diagonal to the long axis of the body. The vitellaria are composed of large follicles distributed as in the other members of the genus; the follicles extend anteriorly to the level of the posterior margin of the acetabulum or slightly beyond, but never farther forward than the anterior margin of the acetabulum. Uterus short, consisting of a few irregular coils almost filling the intercecal space between the anterior testis and acetabulum, and containing from 4 to 40 eggs. Eggs oval,  $68\mu$  long by  $45\mu$  wide, with yellowish brown, thin shells.

*Hosts.*—*Ondatra zibethica* and *Canis familiaris*.

*Location.*—Small intestine.

*Distribution*.—United States (Maryland and District of Columbia).

*Type specimens*.—U.S.N.M. Helm. Coll. No. 29733; paratypes No. 29754.

Two lots of specimens of this species were available for study. The first of these (U.S.N.M. No. 27779) was collected June 1, 1927, by Dr. B. Schwartz, of the Zoological Division, from the small intestine of a dog. The second lot of specimens was collected by Dr. G. Dikmans, February 28, 1930, from muskrat viscera sent to the Zoological Division by Dr. J. E. Shillinger, of the Bureau of Biological Survey, the animals having been caught near Cambridge, Md.

The above description is based on specimens from both sources, the two being regarded as identical since the specimens do not show the slightest difference which might suggest the possibility of the two forms being distinct species.

The genus *Echinochasmus* was proposed by Dietz (1909) to contain three species, *Echinochasmus coaxatus* Dietz, *E. euryporus* (Looss), and *E. beleocephalus* (v. Linstow). Since then the following species have been added: *E. liliputanus* (Looss), *E. africanus* (Stiles), and *E. bursicola* (Creplin) (= *E. cloacinum* Braun) by Odhner (1910); *E. oligacanthus* Lühe (Syn. *E. euryporum* Looss, 1899, not *E. euryporum* Looss, 1896), and *E. perfoliatus* (v. Rätz) by Dietz (1910); *E. prosthovitelatus* by Nicoll (1914); *E. tenuicollis* by Johnston (1917); *E. amphibolus* by Kotlán (1922); *E. botauri* by Baer (1922); *E. elongatus* by Miki (1923); *E. corvus* by Bhalerao (1926); *E. hortense* Goto by Asada (1926); *E. japonicus* by Tanabe (1926); and *E. dietzevi* by Isaichikov (1927).

Lühe (1909) proposed the genus *Episthmium* with *E. africanum* (Stiles) as type and added *E. bursicola* (Creplin). The principal character which Lühe used for the separation of this genus from *Echinochasmus* was the extension of the vitellaria beyond the acetabulum, these glands extending anteriorly as far as the pharynx and uniting in the median line in *Episthmium*, while in *Echinochasmus* they rarely extend as far forward as the anterior margin of the acetabulum. Odhner (1910) refused to recognize Lühe's genus and placed it as a synonym of *Echinochasmus*. Travassos (1923) recognizes the genus *Episthmium* as valid and adds to it two new species, *E. proximum* and *E. oscari*. Bhalerao (1926) concurs in Odhner's action on the grounds that the extension of the vitellaria "is not a very good point of difference" although he later, in the same paper, recognizes that the extension of the vitellaria is a character of generic value. So far as the writer's experience goes, the distribution of the vitellaria appears to be a character of generic value, at

least among the echinostomes, and accordingly recognizes the genus *Episthmium* Lühe. The following species should, therefore, be included in this genus: *E. africanus* (Stiles), *E. bursicola* (Creplin), *E. prosthovitelatus* (Nicoll), *E. proximum* Travassos, *E. oscar* Travassos, and *E. corvus* (Bhalerao). On the basis of extent and distribution of the vitelline follicles, these four species form a very definite and recognizable group.

Odhner (1910) proposed the genus *Heterechinostomum* with *H. mordax* (Looss) as type, and to this genus Stunkard and Haviland (1924) added a second species, *H. magnovatum*. The principal character which Odhner used for separating this genus from *Echinochasmus* was the cirrus pouch which he writes is almost entirely or completely (?) atrophied ("fast gänzlich oder völlig (?) rückgebildet") in *Echinochasmus* and rather weakly developed ("ziemlich schwach entwickelt") in *Heterechinostomum*. The writer does not believe that it is possible to distinguish between "fast gänzlich \* \* \* rückgebildet" and "ziemlich schwach entwickelt," at least not with sufficient certainty to be able to use such a character for the separation of the two genera. *Heterechinostomum* is, therefore, regarded as a synonym of *Echinochasmus*, the two species, *H. mordax* (Looss) and *H. magnovatum* Stunkard and Haviland, becoming *Echinochasmus mordax* (Looss) and *E. magnovatus* (Stunkard and Haviland) respectively.

*Echinochasmus tenuicollis* Johnston, on the basis of the number and distribution of collar spines and the deeply lobed condition of the testes, can not be retained in the genus *Echinochasmus*, but should be included in the genus *Paryphostomum* Dietz; *E. tenuicollis*, therefore, becomes *P. tenuicollis* (Johnston).

*Monilifer pitangi* Lutz is transferred to the genus *Echinochasmus* on the basis of the distribution of the vitellaria, the name therefore becoming *Echinochasmus pitangi* (Lutz). Bhalerao (1926) recognized that this species could not be retained in the genus *Monilifer* (= *Stephanoprora*), but he failed to make the new combination with the generic and specific names.

According to the writer's conception, the following species may be included in the genus *Echinochasmus*<sup>1</sup>: *E. coaxatus* Dietz, *E. euryporus* (Looss), *E. beleocephalus* (v. Linstow), *E. liliputanus* (Looss), *E. oligacanthus* Lühe (in Dietz), *E. perfoliatus* (v. Rátz), *E. amphibolus* Kótlán, *E. botauri* Baer, *E. mordax* (Looss), *E. magnovatus* (Stunkard and Haviland), *E. hortense* Goto (in Asada), *E. japonicus* Tanabe, *E. dietzevi* Isaischikov, *E. pitangi* (Lutz), and *E. schwartzi*, new species.

<sup>1</sup> The writer reserves judgment on *E. elongatus* Miki, as no description of this species is available. It is included here on the basis of an abstract published in the Jap. Journ. Zool., vol. 1, p. 89, 1925.

The species of *Echinochasmus*, *E. schwartzi*, described in this paper is clearly separated from all the above species except *E. oligacanthus*, *E. mordax*, and *E. pitangi* on the basis of the number of collar spines. *E. schwartzi* may be differentiated from *E. oligacanthus* on the size and arrangement of the collar spines and on the comparative size of the suckers. In *E. schwartzi* the collar spines are distinctly smaller than those of *E. oligacanthus*; the row of spines is interrupted dorsally by a space as wide as the oral sucker in the former while in the latter this interruption is very slight. The size ratio of oral sucker to acetabulum is about 1:2 in *E. schwartzi* and more than 1:4 in *E. oligacanthus*. It may be differentiated from *E. mordax* by its shorter anterior body length and by the position of the cirrus pouch which in *E. mordax* lies largely preacetabular, while in *E. schwartzi* the posterior end of the cirrus pouch almost reaches the posterior border of the acetabulum. In addition, the collar spines and eggs of *E. mordax* are considerably larger in proportion to the body size than those of *E. schwartzi*. It is rather difficult to differentiate *E. schwartzi* from *E. pitangi* owing to the extremely meager description of the worm as given by Lutz (1924). Aside from the length, 2.4 to 3.4 mm., the characters given for *E. pitangi* might apply equally to any of the other species of the genus and even to species of some of the other genera. So far as one can judge from the figure of *E. pitangi*, it may be distinguished from *E. schwartzi* in the more posterior position of the testes in the former and in the size of the eggs as compared with the size of the ovary. The eggs as shown in Lutz's figure are longer than the diameter of the ovary and about two-thirds as wide, while in *E. schwartzi* the eggs have no such large size in comparison with the size of the ovary.

### Family UROTREMATIDAE Poche, 1926

#### UROTREMA SHILLINGERI, new species

##### Figure 3

*Specific diagnosis.*—*Urotrema*: Body elongated, 2.6 mm. long by  $418\mu$  wide in the region of the ovary, slightly flattened dorso-ventrally and tapering gradually anteriorly and posteriorly. Cuticle apparently without spines; however, this point can not be determined with certainty from the material available. Oral sucker subterminal,  $112\mu$  in diameter, situated  $487\mu$  from the oral sucker. Prepharynx  $37\mu$  long; pharynx  $67\mu$  long by  $90\mu$  wide; esophagus  $52\mu$  long, bifurcating about midway between the suckers; intestinal ceca simple, extending posteriorly to within a short distance from the base of

the cirrus pouch. Testes oval, situated in the median line in the posterior third of the body, and tandem in position; the anterior testis is  $172\mu$  long by  $142\mu$  wide and the posterior  $187\mu$  long by  $97\mu$  wide, the two testes being separated by a space  $120\mu$  wide. The cirrus pouch is  $202\mu$  long by  $75\mu$  wide at its base, slightly curved, and situated at the posterior end of the body. The genital pore is subterminal, opening on the ventral surface. The ovary is slightly ovoid in shape,  $150\mu$  long by  $120\mu$  wide, and situated about  $90\mu$  caudad of the acetabulum. The shell gland is poorly defined, situated caudad and slightly to the left of the ovary. The uterus is long, running caudally from the shell gland in irregular transverse loops, passing to the right around the anterior testis and to the left around the posterior testis, and terminating in a short metraterm which opens at the genital pore. The vitellaria are situated laterally and composed of small follicles extending from a short distance

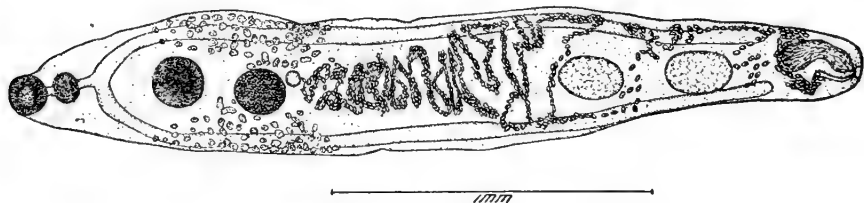


FIGURE 3.—*UROTREMA SHILLINGERI*. VENTRAL VIEW

caudad of the ovary to about the level of the anterior margin of the acetabulum. Eggs oval,  $22\mu$  long by  $15\mu$  wide, brown in color.

*Host*.—*Ondatra zibethica*.

*Location*.—Small intestine.

*Distribution*.—United States (Maryland).

*Type specimen*.—U.S.N.M. Helm Coll. No. 29725.

The above description is based upon a single mature specimen collected by Dr. G. Dikmans from the small intestine of a muskrat, the animal having been trapped near Cambridge, Md., and the viscera sent to the Zoological Division by Dr. J. E. Shillinger, of the Bureau of Biological Survey. The specimen was dead when collected and showed some evidence of maceration, consequently certain details, such as the presence or absence of cuticular spines and the course of the excretory system, could not be determined.

This species differs from *Urotrema scabridum* Braun, the only other species of the genus, in body size, relative size of the suckers, distribution of the vitellaria, distance between testes, and the size of the eggs. *U. shillingeri* is much smaller than *U. scabridum* and the oral sucker is distinctly smaller than the acetabulum in the former, while in the latter species the suckers are about equal in size; the testes are approximated in *U. scabridum*, while in *U. shill-*

*ingeri* they are separated by a distinct space; the vitellaria extend from a short distance cephalad of the anterior testis to the level of the posterior margin of the acetabulum in *U. scabridum*, whereas in *U. shillingeri* these glands extend from a short distance caudad of the ovary to the level of the anterior margin of the acetabulum. The eggs are similar in both species, but those of *U. shillingeri* are somewhat longer than those of *U. scabridum*.

*Urotrema scabridum* was originally described by Braun (1900) as a parasite of Brazilian bats, and this species or a closely related form has been collected by the writer from bats in Texas. This fact, coupled with the fact that only a single specimen of *U. shillingeri* was found in a large number of viscera examined, suggests that the occurrence of this species in the muskrat is only accidental, and that its normal host is some insectivorous mammal such as a bat.

### Family NOTOCOTYLIDAE Lühe, 1909

#### Subfamily NOTOCOTYLINAE Kossack, 1911

#### PARAMONOSTOMUM PSEUDALVEATUM, new species

Figure 4

*Specific diagnosis.*—*Paramonostomum*: Body ovoid,  $387\mu$  to  $496\mu$  long by  $310\mu$  to  $341\mu$  wide, slightly attenuated anteriorly and rounded posteriorly; the dorsal surface is convex and the ventral concave. Cuticle smooth and apparently without spines. Oral sucker  $38\mu$  to  $52\mu$  in diameter, terminal. Esophagus  $10\mu$  to  $15\mu$  long; intestinal ceca simple, the terminal portions passing between the testes. Testes oval,  $113\mu$  to  $120\mu$  long by  $53\mu$  to  $57\mu$  wide, with slightly undulating margins, situated extracellally and opposite each other at the posterior end of the body. The vas deferens extends forward in the median line and expands anteriorly to form a convoluted seminal vesicle which lies free in the parenchyma at the base of the cirrus pouch and to the right of the median line. Cirrus pouch piriform,  $74\mu$  to  $97\mu$  long by  $37\mu$  to  $60\mu$  wide near its base, containing a well-developed prostate and an unarmed cirrus. The genital pore is situated at the posterior margin of the oral sucker. The ovary is irregular in outline,  $75\mu$  to  $90\mu$  long by  $67\mu$  to  $97\mu$

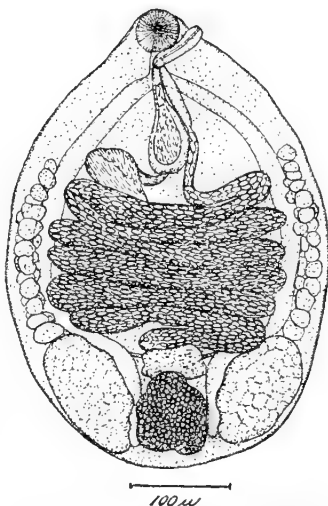


FIGURE 4. — PARAMONOSTOMUM PSEUDALVEATUM. VENTRAL VIEW

wide, situated between the testes and separated from them by the terminal portions of the ceca. Shell gland well developed, lying immediately in front of the ovary. The uterus runs forward in regular transverse coils and terminates in a poorly defined metraterm which is about one-half the length of the cirrus pouch. The vitellaria are extracecal and extend from the anterior margin of the testes to the level of the base of the cirrus pouch. Eggs slightly asymmetrical,  $18\mu$  to  $20\mu$  long by  $10\mu$  wide, provided with a filament at each pole.

*Host*.—*Ondatra zibethica*.

*Location*.—Large intestine.

*Distribution*.—United States (Maryland).

*Type specimens*.—U.S.N.M. Helm. Coll. No. 29726; paratypes No. 29727.

Specimens of this species were collected by Dr. G. Dikmans from the same host viscera in which the two preceding species, *Echinochasmus schwartzi* and *Urotrema shillingeri*, were found.

In addition to the one species described here, the genus *Paramonostomum* contains three species, *P. alveatum* Mehlis (in Creplin, 1846), *P. ionorne* Travassos, 1921, and *P. echinum* Harrah, 1922. Of these species, *P. pseudalveatum* resembles *P. alveatum* more closely than it does either of the other species. It differs from *P. alveatum* chiefly in its smaller size and in the extent of the vitellaria, which in *P. alveatum* extend anteriorly to about the equator of the body while in *P. pseudalveatum* they extend to the level of the base of the cirrus pouch.

The following table gives the essential measurements and other characters of the species that have been included in the genus:

	<i>P. alveatum</i> (from Lühe, 1909)	<i>P. ionorne</i> (from Travassos, 1921)	<i>P. echinum</i> (from Harrah, 1922)	<i>P. pseudalveatum</i> , new species
Length.....	0.6 to 1 mm.....	3.2 mm.....	2 to 2.5 mm.....	387 $\mu$ to 496 $\mu$ .
Width.....	400 $\mu$ to 700 $\mu$ .....	1.5 mm.....	600 $\mu$ to 700 $\mu$ .....	310 $\mu$ to 341 $\mu$ .
Spines.....	(?).....	Absent.....	Present in anterior half of body.	Absent.
Diameter of oral sucker.	50 $\mu$ by 90 $\mu$ .....	210 $\mu$ .....	102 $\mu$ to 125 $\mu$ .....	38 $\mu$ to 52 $\mu$ .
Testes.....	Lobed, almost as wide as long.	Lobed, 500 $\mu$ to 520 $\mu$ by 210 $\mu$ .	Lobed, elongated..	Not lobed, 113 $\mu$ to 120 $\mu$ by 53 $\mu$ to 57 $\mu$ .
Extent of vitel- laria.	To equator of body...	To base of cirrus pouch.	To beginning of second body third.	To base of cirrus pouch.
Egg.....	18 $\mu$ to 21 $\mu$ by 8 $\mu$ to 10 $\mu$ ..	19 $\mu$ by 12 $\mu$ .....	20 $\mu$ by 10 $\mu$ .....	18 $\mu$ to 20 $\mu$ by 10 $\mu$ .
Hosts.....	<i>Anas</i> sp., <i>Anser</i> sp., <i>Branta</i> sp., <i>Cygnus</i> sp., <i>Nyroca</i> sp., <i>Oide-</i> <i>mia</i> sp., <i>Somateria</i> sp.	<i>Chionis alba</i> , <i>Iornornis</i> <i>maritima</i> , <i>Limno-</i> <i>pardalis</i> <i>rythirhyn-</i> <i>chus</i> .	<i>Ondatra zibethica</i> ..	<i>Ondatra zibethica</i> .



## KEY TO THE TREMATODE PARASITES OF THE MUSKRAT

1. Body provided with two suckers-----2.  
Body provided with one sucker-----11.
2. Acetabulum at posterior end-----*Wardius zibethicus*.<sup>2</sup>  
Acetabulum preequatorial-----3.
3. Body divided into two regions, the anterior region being flattened and concave and the posterior cylindrical-----*Hemistomum craterum*.  
Body not divided into two regions-----4.
4. Anterior end of body provided with a collar bearing one to two rows of spines-----5.  
Anterior end of body not provided with collar-----9.
5. Collar bearing 22 spines arranged in a single, dorsally interrupted row.  
*Echinochasmus schwartzi*.  
Collar bearing more than 22 spines arranged in a double, dorsally uninterrupted row-----6.
6. Eggs few in number; cirrus pouch extending to middle of acetabulum.  
*Echinoparyphium contiguum*.  
Eggs numerous; cirrus pouch entirely preacetabular-----7.
7. Length 4.2 to 6.9 mm.; 37 to 41 collar spines, 31 to 33 on rim and 2 to 5 on each ventral lobe-----*Echinostomum callawayensis*.  
Length more than 7 mm-----8.
8. Length 22 to 30 mm.; 35 collar spines, 25 on rim and 5 smaller ones on each ventral lobe-----*Echinostomum coalitum*.  
Length 9.4 to 12.4 mm.; 37 collar spines, 27 on rim and 5 on each ventral lobe-----*Echinostomum armigerum*.
9. Genital pore situated at posterior end of body-----*Urotrema shillingeri*.  
Genital pore preacetabular-----10.
10. Cirrus pouch slender and curved, extending caudad of acetabulum; uterus passing between testes-----*Plagiorchis proximus*.  
Cirrus pouch piriform, not extending caudad of acetabulum; uterus pretesticular-----*Psilostomum ondatrae*.
11. Ventral surface provided with longitudinal rows of glands-----14.  
Ventral surface not provided with longitudinal rows of glands-----12.<sup>3</sup>
12. Genital pore postequatorial and lateral in position; uterine coils anterior to cirrus pouch-----*Nudacotyle novicia*.  
Genital pore preequatorial and median in position; uterine coils caudad of cirrus pouch-----13.
13. Body oval, less than 500 $\mu$  long; cuticle smooth.  
*Paramonostomum pseudalveatum*.  
Body elongate, 2 to 2.5 mm. long; cuticle provided with spines on ventral surface of anterior half of body-----*Paramonostomum echinum*.
14. Ventral surface provided with 3 longitudinal rows of nonprotrusible glands-----*Catantropis filamentis*.  
Ventral surface provided with 3 to 5 rows of protrusible glands-----15.
15. With three rows of glands-----*Notocotyle urbanensis*.  
With five rows of glands-----*Notocotyle quinqueseriale*.

<sup>2</sup>Leidy (1888) reported what he thought to be *Cladorchis subtriquetrus* from the muskrat, but gave no description of the parasite. Barker (1915) regards this as possibly being *Wardius zibethicus*.

<sup>3</sup>Leidy (1858) described a trematode as *Monostomum affine* from the gall bladder of a muskrat, but in view of the fact that the description is of such a nature as to make the species unrecognizable, it is omitted here.

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DESCRIPTION OF A NEW GENUS AND SPECIES OF NEMATODE WORM OCCURRING IN THE NORTHWESTERN BELTED KINGFISHER, WITH A KEY TO THE GENERA OF THE SUBFAMILY ACUARIINAE

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Underneath the corneous membrane of the gizzard of the northwestern belted kingfisher (*Ceryle alcyon caurina*), a bird quite common about the lakes and streams of the United States Range Livestock Experiment Station, Miles City, Mont., small nematodes occur very frequently. The nematode belongs to the family Acuariidae Seurat, 1913, and to the subfamily Acuariinae Railliet, Henry, and Sisoff, 1912. This species belongs to a new genus, for which the name *Aviculariella* is proposed.

The author wishes to express his sincere thanks to Dr. Eloise B. Cram, also of the zoological division, for her very helpful suggestions during the course of this study.

AVICULARIELLA, new genus

*Generic diagnosis*.—Acuariinae: Body delicate, slender, and tapering toward the extremities. Cuticle about head inflated. Cordons restricted to cephalic region, triangular, serrated on their inner borders, not recurrent, but anastomosing posteriorly in pairs in the lateral fields. Spicules unequal and dissimilar. Caudal alae present. Vulva near anus. Parasitic in the gizzard of birds.

*Type species*.—*Aviculariella alcyona*, new species.

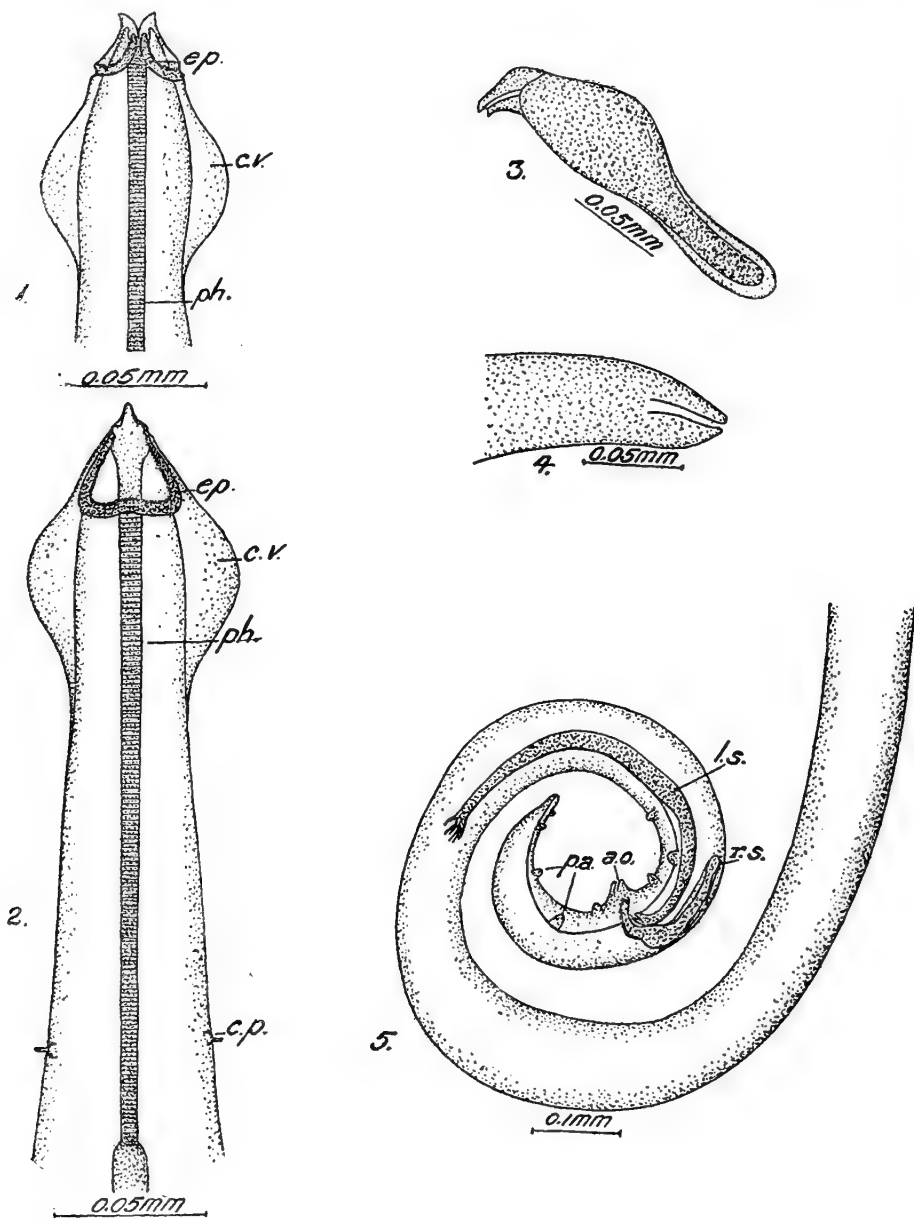
AVICULARIELLA ALCYONA, new species

FIGURES 1 TO 5

*Specific diagnosis*.—*Aviculariella*: Cuticle of the cephalic region much inflated. The cordons, which are confined to the cephalic region, are triangular in shape. Posteriorly the two cordons of each side do not anastomose in an exactly straight line across the body, but anastomose after they have curved very slightly toward the head end.

*Male*.—6 to 7 mm. long by  $102\mu$  wide near the equator of the body. The body is very slender and tapers gradually toward the two ex-

tremities. Cuticle with distinct transverse striations except in the region surrounding the head. The cuticle about the head is dilated and at its broadest point measures  $54\mu$  in width. The cephalic vesicle



FIGURES 1-5.—*Aviculariella alcyona*, new species. 1, Dorsal view of head of female; 2, lateral view of head of female; 3, right spicule; 4, tip of left spicule; 5, posterior extremity of male

a. o., Anal opening; c. p., cervical papilla; c. v., cephalic vesicle; ep., epanulet-like cordons; ph., pharynx; l. s., left spicule; pa., papillae; r. s., right spicule

extends back from the anterior end of the body for a distance of  $119\mu$ . The cervical papillae are located slightly anterior to the union of the pharynx and the anterior division of the esophagus,  $163\mu$  posterior to

the tip of the head, and  $41\mu$  posterior to the termination of the cephalic vesicle. The cordons extend posteriorly from the base of the lips for a distance of  $27\mu$ . The inner edges of the cordons are toothed or serrated. Mouth with two conical, projecting lips, each bearing a pair of submedian cephalic papillae. The caudal extremity is tightly coiled in the preserved specimens, and it was impossible to secure a satisfactory view of either the dorsal or ventral surface. Caudal alae are present and these alae bear 8 pairs of papillae, 5 of which are postanal and 3 preanal. Four of the 5 pairs of postanal papillae are apparently pedunculated, whereas the most posterior pair, situated near the tip of the posterior end, is sessile. The spicules are unequal and dissimilar. The right spicule is short and thick, consisting of a strongly chitinized part which is rounded at the distal end, and a hyaline portion extending beyond this which has a groove cut out of its free end, this portion resembling somewhat a bird's beak; the spicule is  $143\mu$  long and  $34\mu$  wide. The left spicule is nearly three times as long as the right, and more slender, being  $408\mu$  long and  $17\mu$  wide, and has a rounded distal end.

*Female*.—17 to 18 mm. long by  $150\mu$  wide. The head at its widest point is  $61\mu$  wide. The cephalic vesicle terminates  $136\mu$  from the tip of the anterior extremity; the cervical papillae are  $170\mu$  from the anterior extremity. The cordons are triangular in shape as in the male, and extend  $30\mu$  from the base of the lips. The pharynx is 175 to  $214\mu$  long by  $8.5\mu$  wide; the anterior esophagus about  $610\mu$  to  $650\mu$  long, and the posterior esophagus 1.5 to 2.1 mm. long by  $51\mu$  wide. The slightly depressed vulva is situated in the posterior part of the body near the anal opening, the distance between the two orifices being  $476\mu$ . From the vulva the ovejector courses in a posterior direction for a distance of  $360\mu$ , then turns anteriorly to join the uterus. The anal opening lies  $82\mu$  anterior to the tip of the posterior extremity of the body. The embryonated eggs measure  $31\mu$  by  $20\mu$ .

*Host*.—Northwestern belted kingfisher (*Ceryle alcyon caurina*).

*Location*.—Gizzard.

*Distribution*.—Montana (Miles City), United States.

*Type specimen*.—U.S.N.M. No. 29848.

#### KEY TO THE GENERA OF ACUARIINAE

1. Ornamentation of the anterior end in the form of cordons extending posteriorly from the head along the cervical region, usually in the submedian fields (*Acuaria*, s. l.).....2
- Ornamentation of a nature different from the above, or cordons, in either case confined to cephalic region.....8
2. Cordons not recurrent, not anastomosing.....3
- Cordons recurrent or anastomosing, or both.....4

3. Both spicules thick and only slightly unequal; 6 to 8 pairs of postanal papillae.....**Acuaria**  
 Spicules very dissimilar and very unequal; 5 to 7 pairs of postanal papillae.....**Cheilospirura**
4. Cordons not recurrent, but anastomosing.....5  
 Cordons recurrent, anastomosing or separate.....6
5. Cuticle raised in front of postcervical papillae to form a large collar or sheath; cordons anastomose on the free posterior border of the collar.....**Chevreuxia**  
 No such sheath or collar present.....**Echinuria**
6. Cordons recurrent but not anastomosing.....**Dispharynx**  
 Cordons recurrent and anastomosing.....7
7. Cordons form a loop directly after their origin in the head, and not flat against body but applied to margin of plates or alae; lateral alae present on body.....**Cosmocephalus**  
 Cordons with loops lacking at their anterior ends, and applied directly to body; no lateral alae.....**Synhimantus**
8. Cephalic ornamentation consisting of a narrow denticulated collar, which is the margin of a depression surrounding the head at the base of the lips; cervical papillae large and crescent-shaped, with numerous teeth.  
**Streptocara**  
 Cephalic ornamentation not in the form of a collar, but of epaulets or alate appendages; cervical papillae not as above..... 9
9. Cephalic ornamentation consisting of 4 delicate membranous alae directed posteriorly.....**Sciadiocara**  
 Cephalic ornamentation not as above.....10
10. Cervical papillae tricuspid; body with two rows of posteriorly directed hooks.....**Seuratia**  
 Cervical papillae simple; no rows of hooks on body.....11
11. Cephalic ornamentation consisting of two crescent-shaped cordons, the free edges of which are smooth; no cephalic vesicle.....**Rusguniella**  
 Cephalic ornamentation consisting of two triangular-shaped cordons, the inner edges of which are dentate; cephalic vesicle present....**Aviculariella**

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# TWO NEW SPECIES OF NEMATODE WORMS OF THE GENUS *OSTERTAGIA* FROM THE VIRGINIA DEER, WITH A NOTE ON *OSTERTAGIA* *LYRATA*

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Through the courtesy of the Bureau of Biological Survey and of the Pennsylvania Board of Game Commissioners, the writer was afforded an opportunity to examine several abomasums of the Virginia deer (*Odocoileus virginianus*), from Pennsylvania. A total of 16 abomasums were examined, and 11 of these contained nematodes belonging to the genus *Ostertagia* and representing two hitherto undescribed species.

Specimens of the first of these species were referred to the zoological division by Dr. J. D. Jones, of the Pennsylvania Bureau of Animal Industry, Harrisburg, Pa., in March, 1929, and later additional specimens of this species and specimens of the second species were collected by the writer from material sent to the laboratory for examination by representatives of the Pennsylvania Board of Game Commissioners.

*OSTERTAGIA ODOCOILEI*, new species

## PLATE 1

*Specific diagnosis.*—*Ostertagia*—*Male*: About 7.5 mm. long and  $120\mu$  wide just anterior to the bursa. Esophagus,  $560\mu$  long and  $54\mu$  wide at base. Head,  $23\mu$  wide. The cervical papillae are situated about  $300\mu$  from the head end. The nerve ring is located slightly anterior to these papillae. The spicules are  $165\mu$  long and are light brown in color; they are divided distally into three processes, two of which are ventral in position and one dorsal; the dorsally directed process is deeper in color than the remainder of the spicules and terminates in a broad truncated end; the two other processes are sharp-pointed; the outer ventral branch is the longest. There is no gubernaculum. In the general arrangement of the rays of the bursa, this species does not present any striking difference from other members of the genus. The externo-dorsals are comparatively short

and stout. The dorsal ray is about  $50\mu$  long; about  $30\mu$  from its proximal end it divides into two branches, which in turn are cleft at their tips; in the region of the principal bifurcation there are two lateral branches, one on each side. There is the usual accessory bursal membrane supported by two rays. *Female*: About 8.5 mm. long and  $138\mu$  wide in the region of the vulva. Esophagus,  $550\mu$  to  $570\mu$  long, with the cervical papillae about  $310\mu$  from its anterior end. Combined length of the muscular portions of the ovejectors, including the sphincters,  $212\mu$ . Distance from the anus to the tip of the tail,  $225\mu$ . About  $35\mu$  from the tip of the tail there is a slight bulbar swelling. Eggs,  $70\mu$  to  $78\mu$  long and  $38.5\mu$  to  $42.5\mu$  wide.

*Host*.—Virginia deer (*Odocoileus virginianus*).

*Location*.—Abomasum.

*Locality*.—Pennsylvania.

*Type specimen*.—U.S.N.M. Helm. Coll. No. 29427.

#### OSTERTAGIA MOSSI, new species

##### PLATE 2

*Specific diagnosis*.—*Ostertagia*.—*Male*: About 7 mm. long and  $110\mu$  wide just anterior to the bursa. Esophagus,  $740\mu$  to  $775\mu$  long and  $62\mu$  wide at base. Head,  $16\mu$  wide. The cervical papillae are situated  $320\mu$  from the head end. The nerve ring is slightly anterior to the cervical papillae. The spicules are  $175\mu$  to  $190\mu$  in length and are light yellowish brown; in the posterior fourth they are divided into three processes, one dorsal and two ventral; the dorsal process is straight and ends in a blunt tip; the ventral processes are sharp; the outer ventral process is the longest and ends in an acute recurved point. There is a distinct paddle-shaped gubernaculum,  $60\mu$  to  $70\mu$  long. The pattern of the rays of the bursa is similar to that of the other members of the genus, except that the dorsal ray, which is, as usual, bifid with split ends, is without any other accessory processes. *Female*: About 9 mm. long and  $92\mu$  wide in the region of the vulva. Combined length of the muscular portion of the ovejectors, including the sphincters,  $285\mu$  to  $330\mu$ . The vulva is a transverse slit, naked or covered by a backward-projecting flap. Distance from the anus to the tip of the tail,  $170\mu$  to  $175\mu$ . Eggs,  $77\mu$  to  $80\mu$  long and  $38.5\mu$  wide.

*Host*.—Virginia deer (*Odocoileus virginianus*)

*Location*.—Abomasum.

*Locality*.—Pennsylvania.

*Type specimen*.—U.S.N.M. Helm. Coll. No. 29428.

#### A NOTE ON OSTERTAGIA LYRATA

In 1926, Agnes Sjöberg described a new species of *Ostertagia* from cattle in Austria. She gave it the name *Ostertagia lyrata* because

of the lyre-shaped rays of the accessory bursa. (Fig. 1.) What appears to be the same nematode was collected by the writer from the fourth stomach of cattle in Louisiana in 1927. This material, however, differs in some respects from that on which the original description was based. Sjöberg, in describing the spicules of *O. lyrata*, says that the distal end consists of two parts, that is, it is bifurcated, and she suggests the possibility of there being a third process. This has been definitely found to be present, as may be seen from Figure 1. The original description further states that the dorsal ray is double, the two rays touching in their posterior fifths. Examination of the present material shows the dorsal ray to be single, as in the other members of the genus. It is  $90\mu$  to  $95\mu$  in length and bifurcates distally about  $13\mu$  to  $15\mu$  from the end, each bifurcation

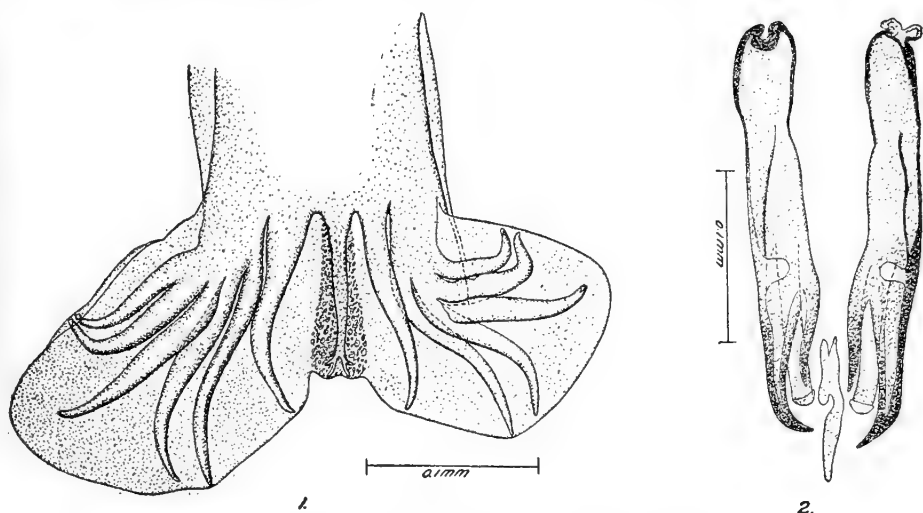


FIGURE 1.—*Ostertagia lyrata*: 1, Bursa; 2, spicules

again dividing near the tip. The dorsal lobe of the bursa is thickened. Sjöberg interprets the structure supported by the lyre-shaped rays as a prolongation of the genital cone. This structure is apparently the accessory bursal membrane common to all species of the genus.

Up to the present, 23 species have been described as belonging to the genus *Ostertagia*. Of these, 18 are reported from ruminants, and 5, all from South America, from animals other than ruminants. Three of the species reported from ruminants differ in some points from the published generic diagnosis, and it is, therefore, desirable to amend the generic diagnosis to include these species, as follows:

#### OSTERTAGIA Ransom, 1907

*Generic diagnosis.*—Trichostrongylidae; Trichostrongylinae: Head, less than  $25\mu$  in diameter, with six indistinct lips or papillae sur-

rounding the mouth. Mouth cavity small. Cervical papillae present or absent. Cuticle marked with 25 to 35 longitudinal ridges appearing as simple lines, except under high magnification when they sometimes show a finely beaded appearance. Cuticle of the head may be slightly dilated, forming a narrow collar, or annulus. Bursa with two lateral lobes united by a smaller median lobe and each lateral lobe supplied with six supporting rays. The two ventral rays usually approach each other near the margin of the bursa. The tips of the medio-lateral, postero-lateral, and externo-dorsal rays are in relation with the posterior border of the bursa. The dorsal ray separates into two main branches, which may divide distally into two short branches or give off one or two short side branches internally or externally. There is an accessory bursal membrane supported by two slender diverging rays. The spicules are short (less than 1 mm. long), similar in size and shape. They may be undivided, bifurcate, or trifurcate in their distal portions. A gubernaculum may be present or absent. Prebursal papillae are present. Vulva is less than one-fifth the length of the body from the posterior end, naked or covered by a thin, backward-projecting, cuticular flap. Ovejectors are well developed. Eggs, oval, with thin shells.

*Type species.*—*Ostertagia ostertagi* (Stiles, 1892), Ransom, 1907.

KEY TO THE SPECIES OF OSTERTAGIA RANSOM, 1907

- |   |         |
|---|---------|
| I. Spicule structure not ascertainable..... | Group D |
| Spicule structure ascertainable.....        | II      |
| II. Spicules undivided.....                 | Group A |
| Spicules divided.....                       | III     |
| III. Spicules bifurcated.....               | Group B |
| Spicules trifurcated.....                   | Group C |

GROUP A.—SPICULES UNDIVIDED

- |  |                    |
|--|--------------------|
| 1. Dorsal ray more than 100 $\mu$ long; gubernaculum trihedral in shape..... | <i>bullosa</i>     |
| Dorsal ray less than 100 $\mu$ long.....                                     | 2                  |
| 2. Gubernaculum present.....   | <i>asymmetrica</i> |
| Gubernaculum absent.....   | <i>houdemeri</i>   |

GROUP B.—SPICULES BIFURCATED

- |  |                     |
|--|---------------------|
| 1. Spicules 700 $\mu$ long.....                      | <i>mentulata</i>    |
| Spicules less than 700 $\mu$ long.....               | 2                   |
| 2. Spicules more than 400 $\mu$ long.....            | <i>turkestanica</i> |
| Spicules less than 400 $\mu$ long.....               | 3                   |
| 3. Dorsal rays originating from a common trunk.....  | <i>khalili</i>      |
| Dorsal rays not originating from a common trunk..... | <i>circumcincta</i> |

GROUP C.—SPICULES TRIFURCATED

- |   |   |
|---|---|
| 1. Distal portion of spicule divided into two ventral processes and one dorsal process..... | 3 |
| Distal portion of spicule not so divided.....   | 2 |

2. Distal portion of spicule divided into one ventral, one dorsal, and one median process-----8  
Distal portion of spicule divided into three processes, of which two arise from the inner or median border of the spicule-----9
3. Outer ventral process obliquely truncated at end-----4  
Outer ventral process not obliquely truncated at end-----5
4. Dorsal ray  $280\mu$  to  $300\mu$  long; bifurcations  $80\mu$  to  $100\mu$  long-----occidentalis  
Dorsal ray  $244\mu$  to  $320\mu$  long; bifurcations  $40\mu$  to  $80\mu$  long-----skrjabini
5. Outer ventral process of spicule sharply pointed and recurved medially-----6  
Outer ventral process of spicule divided distally into three processes; dorsal branch barbed-----7
6. Accessory bursa supported by two lyre-shaped rays-----lyrata  
Accessory bursa supported by two straight rays; bifurcations of dorsal ray without lateral branches-----mossi
7. Outer ventral process of spicule straight; dorsal process barbed-----marshalli  
Dorsal process of spicule truncated-----odocoilei
8. Bifurcations of dorsal ray without lateral branches-----ostertagi  
Bifurcations of dorsal ray with lateral branches-----appendiculata
9. Right spicule terminating in a short, corkscrewlike hook; outer process of spicule not truncated; gubernaculum absent-----bisonis  
Right spicule not terminating in a corkscrewlike hook; outer process of spicule truncated; gubernaculum present-----trifurcata

## GROUP D.—TERMINATION OF SPICULE NOT DETERMINED

1. Stem of dorsal ray five times the length of its branches-----brigantiaca  
Stem of dorsal ray very small-----2
2. Spicules complex,  $163\mu$  to  $170\mu$  long-----ransomi  
Spicules less than  $150\mu$  long-----3
3. Spicules hollowed out in the shape of a gutter,  $134\mu$  long-----callis  
Spicules not hollowed out,  $91\mu$  long-----delicata

The spicules of *O. callis* are figured on Plate 17 of Travassos's monograph of the Trichostrongylidae (1921a), but it is impossible to determine the nature of the termination of the spicules from his figures. They are therefore included in Group D.

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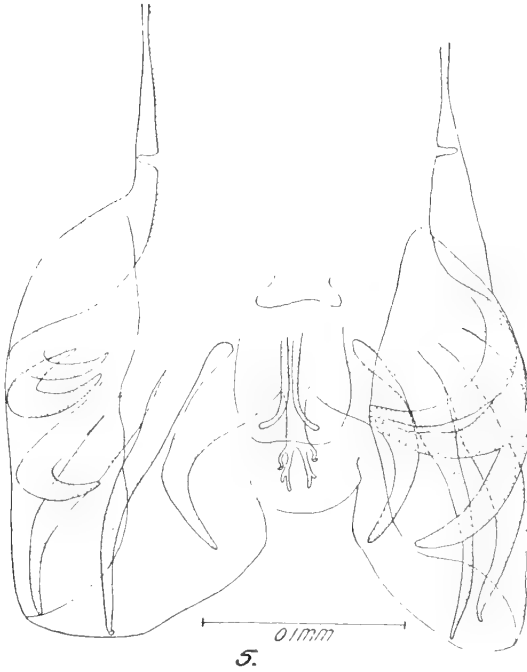
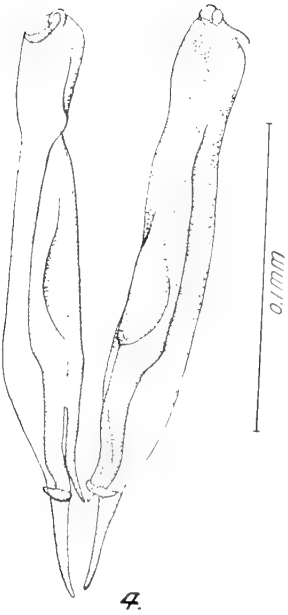
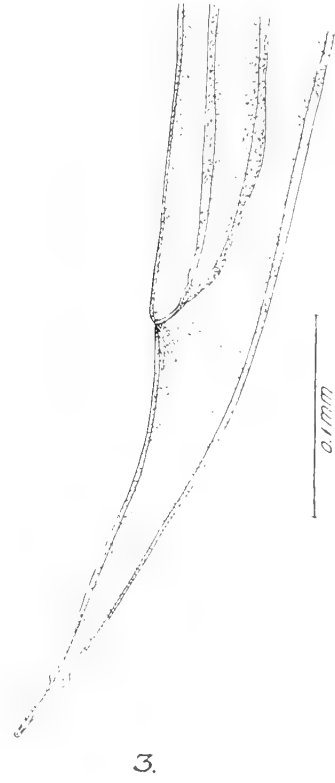
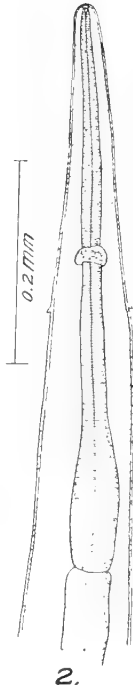
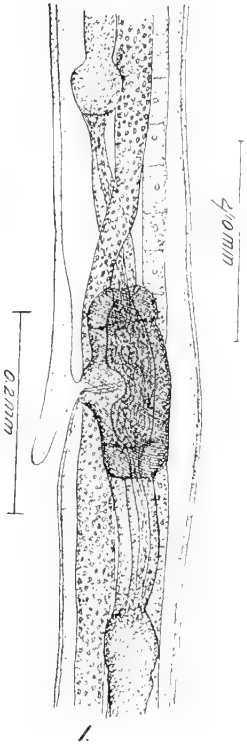
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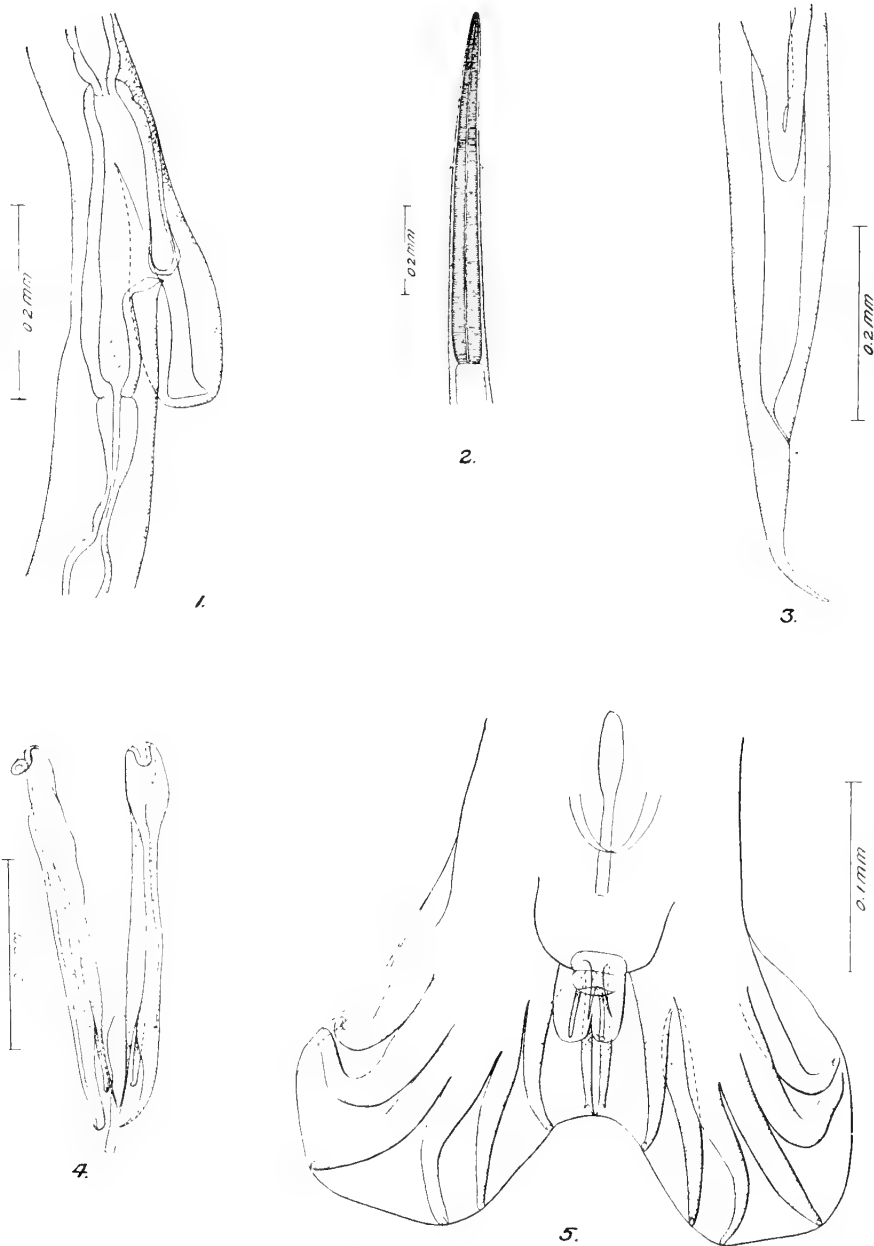
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OSTERTAGIA ODOCOILEI

1, Terminal portion of female genitalia; 2, anterior portion of body; 3, tail end of female; 4, spicules of male; 5, bursa of male.

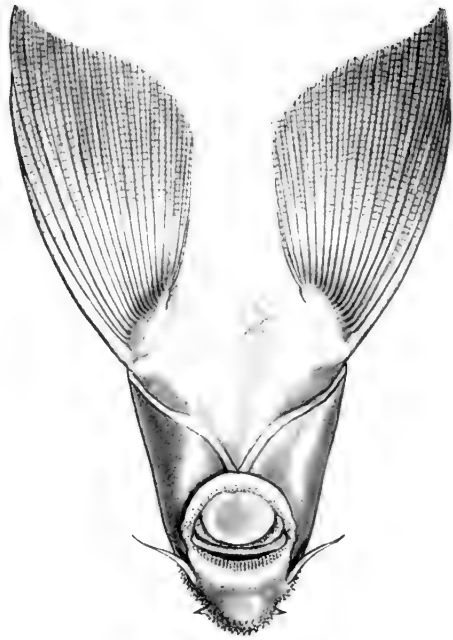
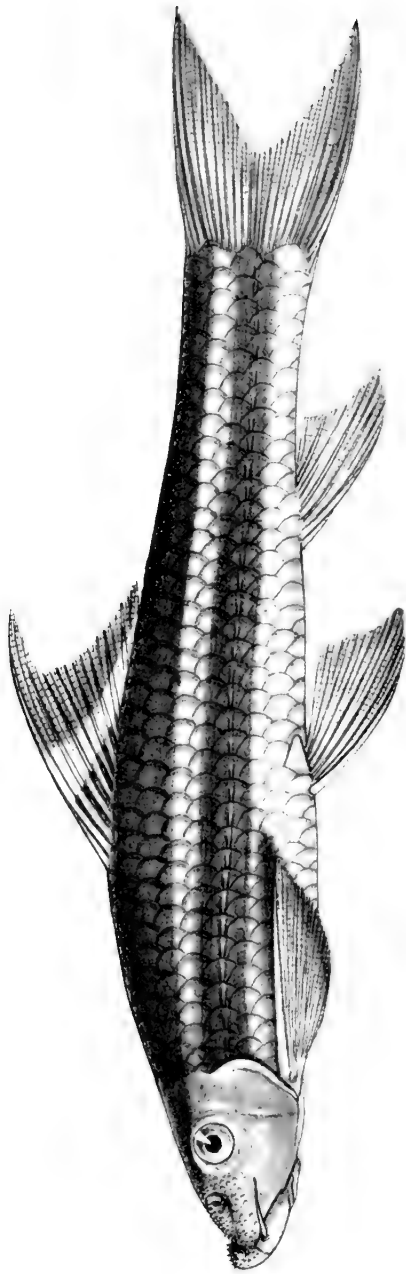


OSTERTAGIA MOSSI

1, Terminal portion of female genitalia; 2, anterior end of body; 3, tail end of female; 4, spicules of male; 5, bursa of male.







GARRA TAENIATA  
SEE PAGE 19.

# DESCRIPTIONS OF NEW GENERA AND SPECIES OF SIAMESE FISHES

By HUGH M. SMITH

*Adviser in Fisheries to His Siamese Majesty's Government*

The collections of fishes made by the writer, his assistants, his friends, and his associates in other branches of the governmental service of Siam during the years 1923-1930 have comprised many thousands of specimens from all sections of the coast and interior. While the field is by no means exhausted, the collections afford a very fair idea of the fish life of the salt, brackish, and fresh waters of the country, and are particularly rich in material from the large and small rivers and the inland swamps, lakes, and canals.

In advance of the preparation of a general account of the fish fauna of Siam, it is thought advisable to place on record some of the apparently undescribed genera and species that have been met with. This paper enumerates 8 new genera and 33 new species belonging in 7 families, as follows:

## COBITIDAE—LOACHES.

*Botia beauforti*, new species.

*Botia horae*, new species.

## CYPRINIDAE—MINNOWS AND CARPS.

*Laubuca caeruleostigmata*, new species.

*Danio kerri*, new species.

*Danio pulcher*, new species.

*Labeo bicolor*, new species.

*Cyclocheilichthys tapiensis*, new species.

*Puntius wetmorei*, new species.

*Puntius stigmatosomus*, new species.

*Poropuntius normani*, new genus and species.

*Barilius koratensis*, new species.

*Barilius pulchellus*, new species.

*Garra taeniata*, new species.

*Epalzeorhynchus siamensis*, new species.

*Scaphognathus stejnegeri*, new genus and species.

## BAGRIDAE—BAGRID CATFISHES.

*Myxus havmolleri*, new species.

## PANGASIIDAE—PANGASSIID CATFISHES.

*Pangasius cultratus*, new species.

*Pangasius beani*, new species.

*Pangasius fowleri*, new species.

*Pangasius sanitwongsei*, new species.

## ARIIDAE—SEA CATFISHES.

*Arius sciurus*, new species.

## SYNAPTURIDAE—SOLES.

*Synaptura aenea*, new species.

## GOBIIDAE—GOBIES.

*Gobiella pellucida*, new genus and species.

*Thaigobiella sua*, new genus and species.

*Pogonogobius*, new genus.

*Eugnathogobius microps*, new genus and species.

*Pipidonia quinquecincta*, new genus and species.

*Herrea formosa*, new genus and species.

*Creisson sealei*, new species.

*Paragobiodon kerri*, new species.

*Rhinogobius similis*, new species.

*Rhinogobius atripinnatus*, new species.

*Cryptocentrus leonis*, new species.

*Apocryptodon malcolmi*, new species.

By permission of His Excellency Chao Phya Baladeb, Minister of Lands and Agriculture in the Cabinet of His Majesty the King of Siam, the type specimens of the fishes herein described have been deposited in the United States National Museum.

**BOTIA BEAUFORTI, new species**

*Description.*—Body oblong, much compressed, the depth 4.3 in standard length, the width at dorsal fin more than 0.5 its depth; caudal peduncle deeper than long, its depth about 0.75 depth of body; dorsal profile a flat, regular curve from snout to caudal, the ventral profile much more arched; head 3.75 in standard length, rather sharply pointed; eye in posterior half of head, small, 9 in head, 4.5 in snout, and nearly 2 in the strongly convex interorbital; the strong, bifid preorbital spine scarcely below level of eye and extending to pupil; mouth small, strongly curved, extending half way from tip of snout to nostrils, lower jaw included; lips thick, tumid, each with a median cleft, lower lip with a rounded mass on each side of symphysis; 6 simple barbels, the 4 rostral ones

forming a long tuft at tip of snout, the 2 maxillary barbels behind angle of mouth, all more than twice diameter of eye.

Fins: Dorsal rays ii,9, the first branched ray more than 0.5 head and equal to base of fin, origin of fin midway between tip of snout and base of caudal; caudal shorter than head, very broad, widely forked, lobes rounded; anal rays ii,5, longest ray less than snout, length of its base less than 0.5 depth of caudal peduncle, origin of fin far behind dorsal base; ventrals inserted under second dorsal membrane, the longest ray equal to longest anal ray, a conspicuous axillary scale; longest pectoral ray exceeds longest dorsal ray and equals snout plus eye.

Color: Body and head light gray-green; sides with 4 irregular longitudinal rows of small, rounded, dark brown spots each surrounded by a pale area; about 5 parallel longitudinal dark brown lines extending on each side of back from head for two-thirds distance to dorsal fin, followed by an area of small dark brown spots

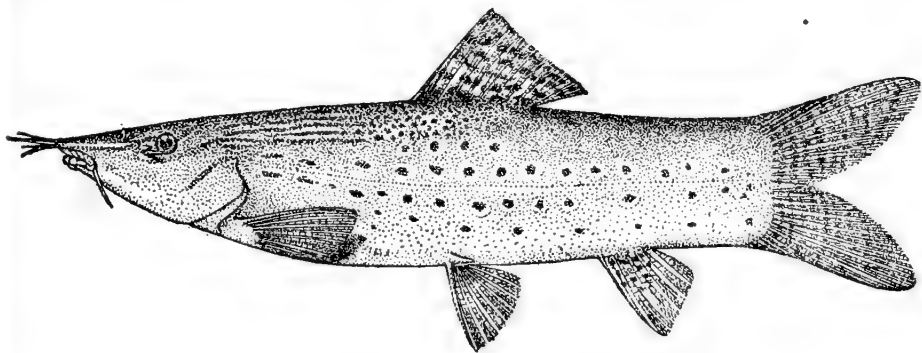


FIGURE 1.—*BOTIA BEAUFORTI*

extending to posterior end of dorsal base; head with several dark brown curved stripes, mostly about eye, one on opercle, one from eye to tip of snout; dorsal and caudal fins bright orange, with rows of black spots; anal fin yellow, with a few brown spots on basal part; ventral and pectoral fins pale orange.

*Type*.—A specimen 17.5 cm. long, taken in Tadi Stream, Ban Kiriwong, Nakon Sritamarat, Peninsular Siam, July 11, 1928. Cat. No. 90285, U.S.N.M.

*Remarks*.—This species is rare in the upper waters of Tadi Stream and tributaries. Only one specimen was obtained, but the people at Ban Kiriwong know the fish and call it *pla mu* (hog fish), a name shared by no other species in that section. The maximum size attained, according to local people, is about half longer than the type.

The nearest relative of this species appears to be *Botia berdmorei* (Blyth), from Burma. As described and figured by Day,<sup>1</sup> that

<sup>1</sup> Fishes of India, p. 607, pl. 154, fig. 3.

species presents a number of differences in form and color, such as 11 to 13 branched dorsal rays (instead of 9), origin of ventral slightly in advance of dorsal (instead of considerably behind), depth of caudal peduncle less than its length (instead of more), 10 or 11 dark vertical cross bands extending from back of abdomen (instead of none), the absence of parallel black stripes on the back anteriorly, etc.

This species is named for Dr. L. F. de Beaufort, of Amsterdam, accomplished coauthor of *Fishes of the Indo-Australian Archipelago*.

**BOTIA HORAE, new species**

*Description*.—Moderately elongate, compressed, depth 3.6 in standard length; caudal peduncle short and deep, its least depth less than its length and two-thirds depth of body; dorsal and ventral outlines similar; head 3.25 in length; eye 5.5 in head, more than 2 in

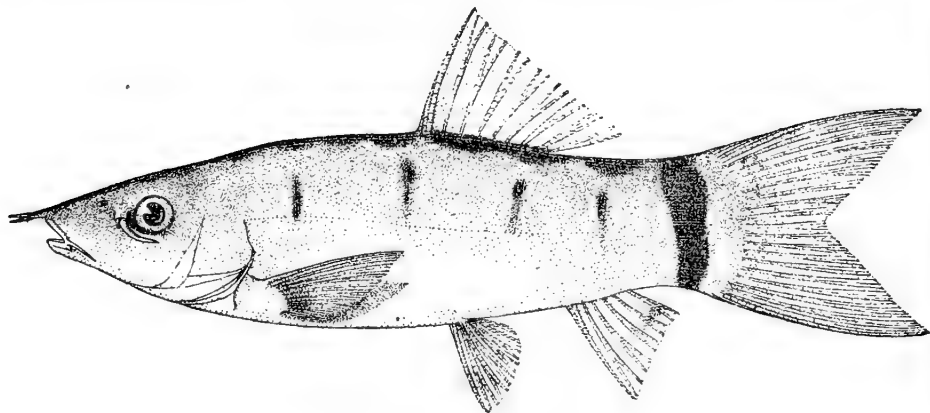


FIGURE 2.—*BOTIA HORAE*

snout and less than interorbital space; mouth small, semicircular, rictus less than eye; 6 short, subequal barbels, all less than eye; suborbital spine strong, longer than eye, extending to a point under posterior edge of pupil.

**Fins:** Dorsal rays ii,8, margin of fin nearly straight, first branched ray as long as snout and eye and about two-thirds depth of body, origin of fin slightly in advance of ventrals and nearer base of caudal than to tip of snout; caudal as long as head, broad, deeply forked, the lobes pointed; anal rays ii,5, origin of fin slightly posterior to dorsal base, longest ray less than depth of caudal peduncle; ventrals shorter than pectorals whose first ray exceeds first dorsal ray and is 1.5 in head.

**Color:** Pale yellowish green; a median dorsal stripe from tip of snout to beyond dorsal fin, the stripe formed by jet black rounded spots and blotches joined by dark areas; a broad jet black cross-

band near middle of caudal peduncle, the bands on the two sides meeting above and below; 4 narrow, vertical blackish bands on side mostly above lateral line, the first above pectoral, the second slightly in advance of dorsal, the third under posterior part of dorsal base, the fourth over anal; fins mostly plain, several vague dark lines across base of caudal, an obscure dark blotch on posterior part of anal.

*Type and paratype.*—The type, 4.0 cm. long, was taken in the west fork (Kwe Noi) of the Meklong, Western Siam, September 24, 1929. Cat. No. 90286, U.S.N.M. A paratype is 3.7 cm. long.

*Remarks.*—This attractive and easily recognized little cobitid is named for Dr. Sunder Lal Hora, of the Indian Museum in Calcutta, in slight recognition of his valuable studies of Siamese, Burmese, and Indian fishes.

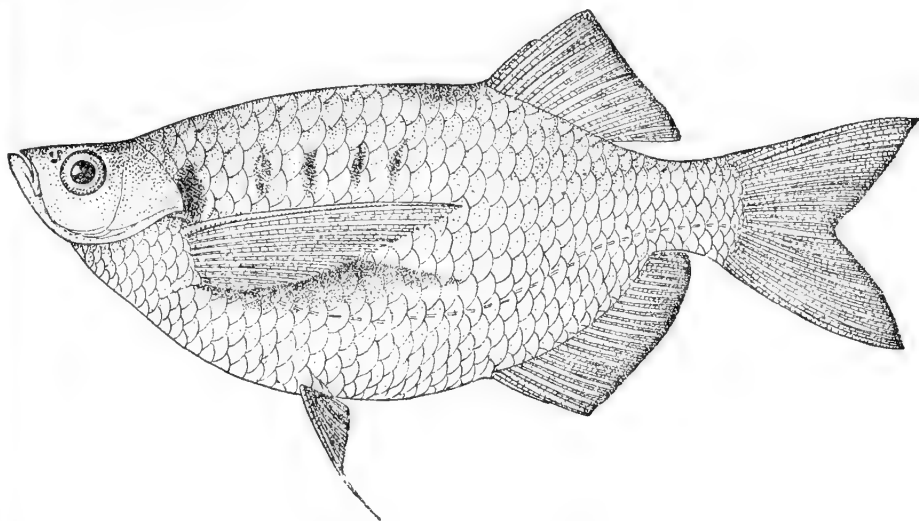


FIGURE 3.—*LAUBUCA CAERULEOSTIGMATA*

***LAUBUCA CAERULEOSTIGMATA*, new species**

*Description.*—Form short, deep, greatly compressed; upper profile from snout to dorsal slightly curved, with a slight concavity at nape; profile from chin to ventrals very steep, ventral curvature greater than dorsal; depth 2.25 in standard length; caudal peduncle short, deeper than long, 0.5 head; head sharp, short, 4.2 in standard length; mouth small, almost vertical, lower jaw slightly longer, its tip on level with upper margin of eye, angle of mouth not reaching vertical from anterior margin of eye; eye 3.5, in anterior half of head, 1.5 in interorbital space, and slightly less than snout; scales larger anteriorly, about 35 in lateral line, 13 in transverse series between origins of dorsal and anal, 12 around caudal peduncle,

19 in predorsal region; lateral line markedly decurved, running on lower half of caudal peduncle, and separated by 4.5 or 5 rows of scales from ventral base and by 8.5 or 9 rows from dorsal origin.

Fins: Dorsal placed far backward, its origin opposite that of anal and midway between anterior edge of pupil and tip of upper caudal lobe, its longest rays equal to its base and to head less snout; dorsal rays ii,11; caudal longer than head, deeply forked; anal base as long as caudal, its margin slightly rounded, the longest rays shorter than dorsal rays; rays ii,22; ventrals placed a little above edge of abdomen, their first ray produced into a filament, more than 0.5 pectorals and reaching anal aperture; pectorals very long, more than 1.75 times length of head, their tip nearly reaching a line from origins of dorsal and anal.

Color: Upper parts light green, sides and lower parts silvery white; a round well-defined caerulean blue spot on top of head behind eyes and about size of eyes; a similar-colored area on median line of back extending from dorsal fin nearly half-way to head; a blackish-green spot about size of eye immediately behind head; dorsal and anal hyaline, pectorals and ventrals dusky, caudal very pale blue.

After preservation in formalin or alcohol there appeared a series of 4 short vertical blackish stripes alongside before the dorsal fin and on level with the eye, and the blue spots disappeared.

*Type*.—A specimen 6.2 cm. long over all, from the Menam Chao Phya below Nakon Sawan, Central Siam, January 5, 1925. Cat. No. 90287, U.S.N.M.

*Paratypes*.—Nine other specimens taken at the same time and place. Two of these have been presented to the Zoological Museum in Amsterdam and one to the Indian Museum, Calcutta. One additional specimen was taken from a fish chute in one of the streams flowing out of Borapet Swamp, near Paknampo, Central Siam, November 20, 1923, and another in the Menam Chao Phya near Chainad, Central Siam, in December, 1924.

*Remarks*.—The color of the back of this fish harmonizes with the water and makes the fish almost invisible from above, except for the two brilliant caerulean spots on the top of the head and the median line of the back before the dorsal fin. Fishes kept alive in a pail of river water and viewed from above were quite inconspicuous except for the blue spots. Exceptionally 7 to 9 dark vertical stripes appear along the side in formol specimens.

**DANIO KERRI, new species**

*Description*.—Moderately elongate, the depth 3.3 in standard length; head equal to depth; eye about equal to snout, 4 in head, 1.25



in interorbital space; two pair of slender barbels, the rostral extending behind eye, the maxillary slightly beyond gill opening; least height of caudal peduncle 2 in head; no lateral line; scales in lateral series 31, in transverse series 9, 16 scales before dorsal, caudal peduncle surrounded by 10 scales in its narrowest part; head profusely covered with tubercles probably indicative of the breeding condition, one conspicuous oval patch of tubercles at outer angle of lower jaw, with a linear patch inferior and posterior thereto, another elongated patch below eye, and other tubercles above eye, on lower lip, and on chin.

Fins: Dorsal rays ii,7, origin of fin in advance of anal, over 14th scale of lateral series, its height more than 0.5 head; caudal deeply emarginate, as long as head; anal rays ii,2, height of fin equal to dorsal; ventrals short, not reaching vent; pectorals shorter than head, not reaching base of ventrals.

Color: Back reddish, a median bluish stripe from occiput to dorsal fin; top of head and muzzle bluish; side with a broad, dull blue band which extends on opercle and is traversed by bright scarlet lines as follows: a continuous straight stripe from upper end of branchial opening to caudal base, becoming wider posteriorly; a somewhat broader, wavy stripe beginning on sixth scale of lateral series and extending to lower edge of caudal peduncle immediately posterior to anal fin; a short stripe between the above two, reaching slightly further back than anal origin and decurved anteriorly; a fourth interrupted broad stripe beginning at gill opening and running along the body above the base of anal fin; in line with the upper margin of eye a line of vermiculations from head to a point under dorsal fin; belly white; all fins dusky, the dorsal and caudal with pale red edges, a diffuse bluish spot on the middle of the caudal base, the anal with pale red rays.

*Type*.—A male specimen 4.2 cm. long over all, 3.3 cm. to base of caudal, collected in a pool in a hill stream on Koh Yao Yai, west coast of Siam, March 4, 1929. Cat. No. 90289, U.S.N.M.

*Additional specimens*.—There are 3 other specimens taken at the same place and time, the largest a male 3.7 cm. long, the other apparently females 3.3 and 3.5 cm. long. The male exhibits the same nuptial tubercles as the type, and the other specimens show no such organs. In all of these specimens the maxillary barbel extends well behind the branchial opening.

*Remarks*.—The species is somewhat like *Danio albolineata* (Blyth), known from Burma, Penang, and Sumatra, which has an incomplete lateral line and a single scarlet band which extends along the side from the caudal base to a point under or slightly in advance of the

dorsal fin. The only other species of the genus which this new form resembles is *D. rerio* (Hamilton Buchanan), known from Eastern India, in which there are on the side 4 metallic blue lines separated by 3 silvery ones, together with 3 to 6 blue bands on the caudal fin and 3 blue bands on the anal.

The species is named in honor of Dr. A. F. G. Kerr, botanist of the Siamese government, who collected the type and cotypes.

DANIO PULCHER, new species

*Description.*—Similar to *D. albolineatus* (Blyth) from Sumatra and Burma, but the lateral line absent and the coloration markedly different. The barbels are in two pairs and well developed, the dorsal and anal rays are in reduced number, and the scales are relatively large. Depth of body contained 3.5 times in standard length, 4.5 in total length; head short, blunt, 4.2 in standard length, 5 in length to fork of tail, 1.2 in depth of body; least depth of caudal peduncle less than 0.5 head; eye situated low on side of head, 3 in head, longer than snout and 0.75 interorbital space; mouth nearly vertical, lower jaw slightly projecting, maxillary not reaching vertical from anterior border of eye; rostral barbel 2 times eye, 0.5 maxillary barbel, extending beyond preopercle; maxillary barbel reaching far beyond base of pectoral; lateral line entirely absent; scales in lateral series 34, in transverse series 9, around caudal peduncle 12.

Fins: Dorsal rays ii,7; origin of fin well in advance of anal, longest ray less than head; caudal deeply emarginate, much longer than head; anal rays iii,15, longest ray somewhat less than head without snout, and base scaly and about equal to head; ventrals extending to vent; pectorals long, equal to head and nearly reaching ventrals.

Color in life: General color of back and sides pale green, top of head darker green; belly and chin pale yellow, chest pale orange, flank above anal fin and lower side of caudal peduncle pale blue; a narrow indigo blue median dorsal stripe from head to front of dorsal fin and from posterior end of dorsal to caudal fin; a narrow, diffuse, dull orange band on back from head to caudal fin, separated from a median blue stripe by a narrow space; a bright orange-red lateral band from gill opening to base of caudal fin gradually becoming wider posteriorly; below this band a similar one of Antwerp blue; the orange-red band bordered above posteriorly by a narrower band of Antwerp blue, and the blue band bordered below posteriorly by a narrower band of orange-red; iris pale, with spots of crimson lake; dorsal fin pale green at base, a band of darker green extending midway its length, the distal part of fin chrome yellow,

with a broad bright vermillion margin; caudal fin pale green, the central part and the posterior margin scarlet; anal fin scarlet at base, a medial band of deep green, the distal half chrome orange, with a narrow sky-blue edge; ventrals pale yellow at base, merging into pale green distally; pectorals pale green, the first ray darker and sharply defined. In formalin, the lateral bands remain distinct, but the red color becomes white and the blue becomes blackish.

*Type*.—A male specimen 32.5 mm. long over all, taken in a waterfall stream at Pliew, Chantabun Province, Southeastern Siam, April 9, 1925. Cat. No. 90290, U.S.N.M.

*Paratypes*.—Five specimens taken at same place and date, 4 of them males from 30 to 32.5 mm. long, 1 a female 37.5 mm. long with ripe eggs.

*Remarks*.—This species falls in the subgenus *Brachydanio* of Weber and Beaufort, characterized by having the lateral line incomplete or absent and 7 branched rays in the dorsal fin. It is one of the smallest members of the genus, apparently surpassed in diminutiveness only by *D. nigrofasciatus* Day from Burma which does not exceed 25 mm.

The fish is thus far known only from the waterfall stream at Pliew, where it was collected by Luang Masya Chitrkarn, of the Siamese Department of Fisheries. The fish seems to be restricted to the upper part of the stream where it flows over and among boulders and between banks densely overgrown with trees and other vegetation.

The only species of *Danio* heretofore recorded from Siam is *D. aequipinnatus* (McClelland), of India, Ceylon, and Burma, known only from the Nakon Sritamarat Mountains in Peninsular Siam.<sup>2</sup>

#### LABEO BICOLOR, new species

*Description*.—Form elongate, moderately compressed, depth 3.5 in standard length; head slightly less than depth, subconical; snout obtusely pointed, overhanging the mouth, and with a small lobe and a deep groove on each side; eye in the middle of length of head, 4.5 in head, 1.5 in snout, and somewhat less than 2 in the strongly convex interorbital space; mouth moderate, transverse, a long postlabial groove extending straight backward; 2 pairs of barbels of equal length, about equal to eye, the rostral pair close together, separated by a space equal to half eye and extending to angle of mouth; scales in lateral series 34, in transverse series 6–1–7, scales before dorsal 11, scales around caudal peduncle 16; lateral line nearly straight.

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<sup>2</sup> See Journ. Nat. Hist. Soc. Siam, vol. 6, p. 153.

Fins: Dorsal large, slightly emarginate, its origin well in advance of ventral base, opposite 10th scale of lateral line, the rays ii,13, first branched ray about equal to depth of body; caudal deeply forked, its pointed lobes longer than head; anal rays iii,5, the longest reaching nearly to base of caudal but shorter than longest dorsal ray; ventrals extending to anal; pectorals somewhat shorter, not reaching ventrals.

Color: Entire body and all fins except caudal and pectorals uniform black; in larger specimens the belly and under side of head may be bronze; caudal and pectorals bright orange, the color of the caudal extending on the caudal peduncle and involving the last 2 or 3 transverse rows of scales; in small examples a narrow whitish edge to dorsal and anal.

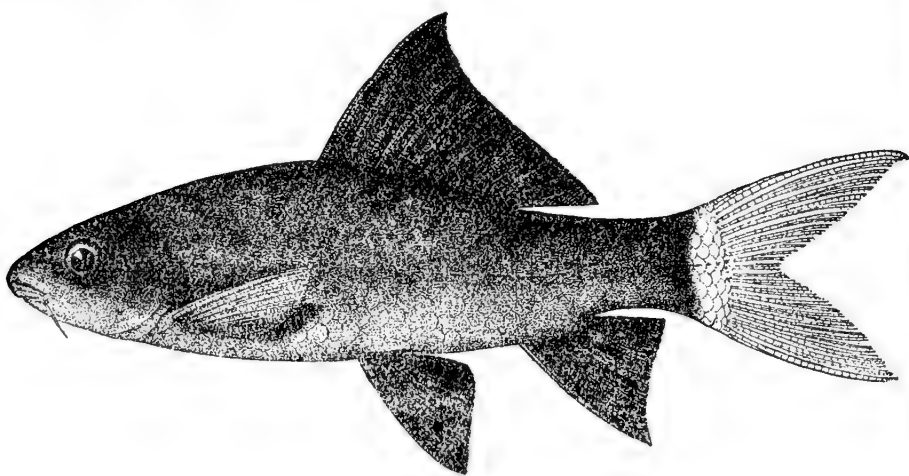


FIGURE 4.—*LABEO BICOLOR*

*Type*.—A specimen 10.8 cm. long over all, 8.5 cm. to base of caudal, taken November 19, 1923, in a fish chute in a small tributary of the Menam Chao Phya near Paknampo, Central Siam. Cat. No. 90291, U.S.N.M.

*Other specimens*.—In addition to a number of specimens forwarded to foreign correspondents, the collection of the Siamese Department of Fisheries contains 10 specimens taken from a small stream near Paknampo November 20, 1923, and several specimens taken in the Menam Chao Phya at Nontaburi in December, 1921, by Dr. Malcolm Smith.

*Remarks*.—This fish is not uncommon in Borapet Swamp, Central Siam, and in the streams leading therefrom. It is reported to be very common at times at Hangkraben, above Ayuthia, and occurs also in the Menam Chao Phya as far south as Bangkok. The maximum length appears to be about 12 cm. In the Paknampo region the fish is called *pla song kruang* (full-dress fish).

The nearly uniform rich velvety black of the body and most of the fins is strikingly relieved by the bright orange color of the caudal and pectoral fins, making this one of the most beautiful of the many attractively colored cyprinoid fishes of Siam. Specimens preserved in alcohol or formalin ultimately become brown, and there appears on the side above the lateral line a short distance behind the head a small round black spot that is scarcely visible in life; one or two smaller spots sometimes appear beneath the other.

**CYCLOCHEILICHTHYS TAPIENSIS, new species**

*Description.*—Back moderately elevated, the dorsal profile from nape to dorsal fin gently curved; depth 3 in standard length; least depth of caudal peduncle 2.5 in head; head about 3.5 in standard

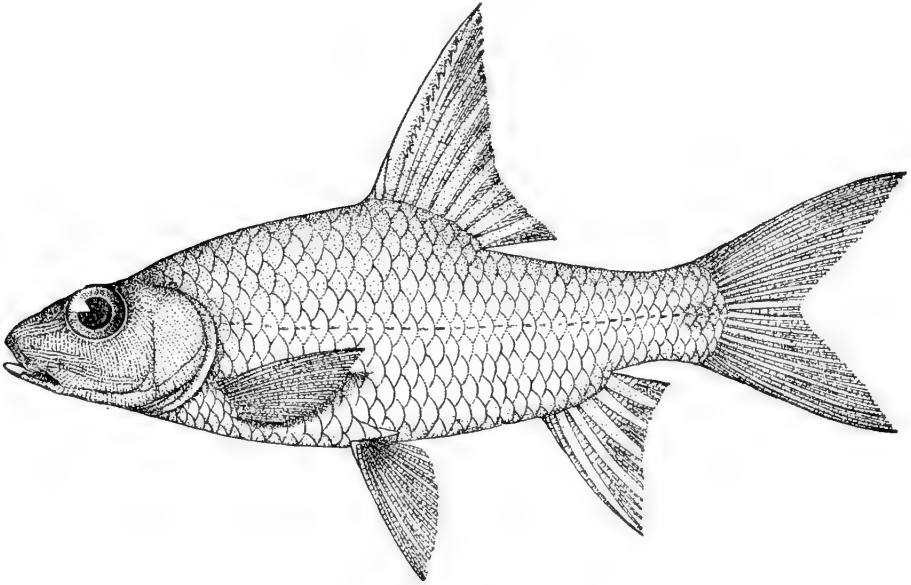


FIGURE 5.—CYCLOCHEILICHTHYS TAPIENSIS

length; eye large, about equal to snout, 3.2 in head, and about 1 in the slightly concave interorbital space; 2 pairs of barbels, the rostral minute, the maxillary less than 0.5 diameter of eye; lines of sensory pores on sides and top of head very prominent; scales in longitudinal series 37, in transverse series 6–1–6.5, around narrowest part of caudal peduncle 16, in predorsal region 12.

Fins: Dorsal origin behind that of ventrals and midway between tip of snout and base of caudal; dorsal rays iv,8, the fourth simple ray strongly denticulated on posterior border, its length equal to head; caudal deeply forked, the lobes pointed and as long as head; anal rays iii,5, the third simple ray osseous and as long as head less snout; ventrals extending beyond vent but not reaching anal; pec-

torals 0.75 head, equal to ventrals and extending slightly beyond their base.

Color: Plain silvery, a round dusky spot on caudal peduncle; fins hyaline.

*Type*.—A specimen 13.0 cm. long taken in the Tapi River near Bandon, Peninsular Siam, September 30, 1923. Cat. No. 90294, U.S.N.M.

*Other specimens*.—The collection of the Siamese Department of Fisheries contains a specimen 16.0 cm. obtained from Bandon Bight, Gulf of Siam, September 19, 1923, where it had evidently strayed in the flood water from the Bandon River; and a second specimen, 12.0 cm. long, from the Tapi River near Bandon, September 30, 1923, which shows faintly a dark brown spot at the base of each of the scales on back and sides and a small round dark brown spot on caudal peduncle at base of fin.

*Remarks*.—This species is closely related to *C. armatus*, known from Sumatra, Java, and Borneo as well as from Siam, but differs therefrom in having a much less steep and arched dorsal profile, more slender body, more elongate caudal peduncle, and plainer coloration. From Bleeker's *C. dumerili*, known from a single specimen from Bangkok and imperfectly described by Sauvage,<sup>3</sup> this form appears to differ in having a longer head, larger eye, more scales in transverse series, and longer dorsal fin arising well behind the origin of ventrals instead of a little in advance.

This fish at Bandon is known as *pla kamprad* (slippery fish). It is reported to be a small form, not exceeding in size the largest specimen herein listed.

#### PUNTIUS WETMOREI, new species

*Description*.—Form elongate, moderately compressed, dorsal and ventral profiles similar; back slightly arched, a slight concavity at nape; depth 2.6 in standard length; least height of caudal peduncle about equal to eye and 0.8 its own length; head 4 in length; eye large, equal to snout, 0.2 less than postorbital part of head and 1.3 in interorbital space; snout rounded, jaws nearly equal, lips thin, mouth small, maxillary not reaching vertical from anterior margin of eye; barbels 4, short, rostral pair reaching eye, maxillary pair longer but less than diameter of eye; scales large, 23 or 24 in lateral line, 5.5–1–4.5 intransverse series, 8 before dorsal, 12 surrounding narrowest part of caudal peduncle; lateral line decurved and irregular but complete.

Fins: Dorsal rays iv,8; origin of fin opposite ventrals and over eighth scale of lateral line, nearer to tip of snout than to base of

<sup>3</sup> Recherches sur la fauna ichthyologique de l'Asie et description d'espèces nouvelles de l'Indo-Chine, 1880.

caudal, free margin deeply concave, the last ray produced; fourth unbranched ray strong, osseous, bearing 8 very large teeth on its posterior edge, its length somewhat more than head; caudal deeply forked, the pointed lobes longer than head; anal rays iii,5, the longest 0.8 head and reaching caudal, the posterior edge of fin deeply emarginate; ventrals 0.8 head, reaching vent, their base separated from lateral line by 2.5 scales, a large scale in axil; pectorals of same length as ventrals.

Color: Back reddish-brown, sides and under parts golden; a very distinct rounded greenish spot on side above pectoral base (disappearing in formol); a dark area on opercle; dorsal fin pale greenish-yellow, dark edged; caudal pale green, margin dark, inferior part of lower lobe yellow; anal, ventrals, and pectorals bright orange.

*Type*.—A specimen 12.5 cm. long from the Menam Chao Phya at Chainad, Central Siam, January 5, 1925. Cat. No. 90295, U.S.N.M.

*Remarks*.—This is a well-marked form characterized by large scales, a very strong coarsely-serrated fourth dorsal ray, two pairs of barbels, a complete lateral line, and brilliant coloration. In some of its features the species resemble *P. anchisporus* from Borneo, but is more elongate, has a less strongly arched dorsal profile, has fewer scales surrounding the caudal peduncle and is of very different coloration. *P. sumatranus*, from Siam, Sumatra, and Borneo, has no rostral barbels, has an incomplete lateral line, and has 4 dark crossbands on head and body. In the widely-distributed *P. notatus* the barbels are longer, the dorsal margin is truncate, the fourth simple dorsal ray is shorter, the anal is much shorter, the body usually has a round black spot under dorsal fin and another on caudal peduncle, and there are other dissimilar features.

This species is named in honor of Dr. Alexander Wetmore, assistant secretary of the Smithsonian Institution in charge of the United States National Museum.

#### PUNTIUS STIGMATOSOMUS, new species

*Description*.—Dorsal profile moderately arched; depth of body 3.2 times in standard length, a little less than 4 in total length; head 3.75 in standard length; eye equal to snout and interorbital space, and contained 3.25 times in length of head; mouth strongly arched, subterminal; a barbel at corner of mouth about equal to eye, no rostral barbels; caudal peduncle broad, its depth about two-thirds its length and more than 0.5 head; scales large, 26 in lateral line and 9 in transverse series, 4.5 rows being above the lateral line, and 2.5 rows between lateral line and base of ventrals, 10 predorsal scales, 12 scales around narrowest part of caudal peduncle; thin scales extend from the body on the bases of the dorsal and anal fins and form a sheath; lateral line moderately decurved, the pores weakly developed.

Fins: Dorsal rays ii,8, the second simple ray osseus and serrated; origin of fin posterior to origin of ventrals, over eighth scale of lateral line and much nearer to end of snout than to base of caudal; dorsal fin high, nearly 0.75 depth of body and 0.8 length of head, its posterior margin truncate; caudal as long as head, deeply forked, the lobes pointed; anal rays iii,5, the simple rays weak and unossified; pectorals rounded, 1.3 in head, reaching ventrals and somewhat longer than they, which do not extend to anal.

Color: Upper part of body and top and sides of head greenish, below silvery white; a row of four roundish black spots on side, the first near head, the second under dorsal, the third above anal origin, the fourth on caudal peduncle on both sides of the lateral line; an-

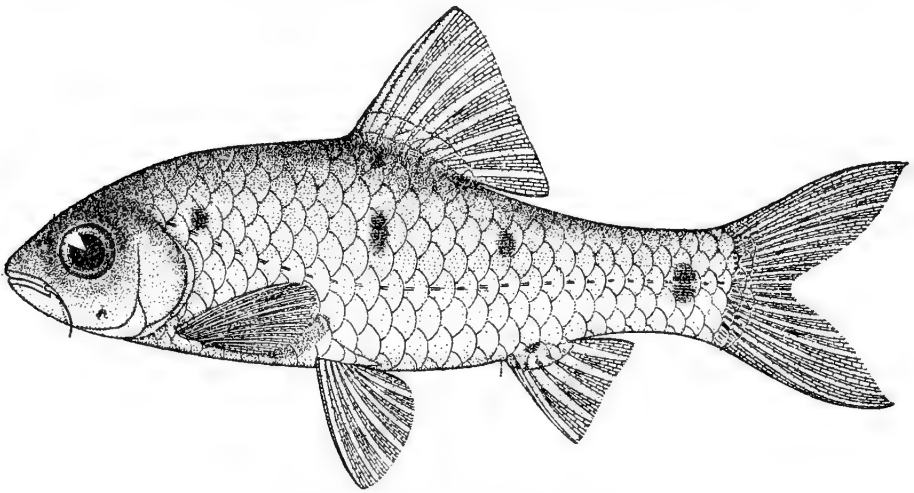


FIGURE 6.—*PUNTIVS STIGMATOSOMUS*

other small round black spot immediately under the first branched dorsal ray; a smaller black spot above the anterior part of anal; fins hyaline.

*Type*.—A specimen 5.5 cm. long, collected by Luang Masya Chitrakarn, of the Siamese Department of Fisheries, April 27, 1927, at the waterfall in Pliew Stream, Kao Sabap, near Chantabun, Southeastern Siam. Cat. No. 90296, U.S.N.M.

*Remarks*.—Similar to *P. binotatus*, known from Siam, Straits Settlements, and Indo-Australian Archipelago, but differing therefrom in absence of rostral barbels (which in *notatus* are longer than eye), in more anterior position of the dorsal fin, and in pattern of coloration.

#### POROPUNTIUS, new genus

Moderately elongated and compressed; snout bluntly rounded, its median part covered with rows of large pores, the pore-bearing area defined laterally by a deep groove; mouth subterminal, lips con-



tinuous, lower lip with a postlabial groove which is interrupted in the middle by a short space; a sulcus separating lower lip from lower jaw, which is included and has a horny covering; rostral and maxillary barbels well developed, the former inserted at the base of the rostral groove; scales large; dorsal fin with 8 branched rays, its last simple ray osseous, stout, and strongly denticulated; anal with 5 branched rays, its simple rays unossified; gill-membranes joined to isthmus.

This genus resembles *Lissochilus* from Southern Asia and Sumatra, in having the lower jaw covered with a horny sheath and a deep sulcus separating it from the lower lip. The pores on the snout in *Lissochilus* are surmounted by horny tubercles which extend to below the eye, and the last simple dorsal ray is weakly ossified and not denticulated. There is no rostral groove.

In *Puntius* the last simple dorsal ray may be ossified and serrated, but there are no pores on the snout, no horny sheath on lower jaw, and no rostral groove.

In the Bleekerian genus *Barbodes*, which Weber and Beaufort place in the synonymy of *Puntius*, the essential character is the possession of 4 barbels. The Indian cyprinids placed by Day (Fishes of India) in the *Barbodes* group of the composite genus *Barbus* include some forms which have the last simple dorsal ray denticulated and one of those species, *B. chaganio*, has pores on the snout and other parts of the head; this fish, however, has no horny covering on the lower jaw and no rostral groove; and in the only Indian species (*B. lithopidus*) mentioned as having a covering on the lower jaw (Day's description reads: "a thin cartilaginous covering internally to either jaw") the last simple dorsal ray is not denticulated or even osseous and there are no rostral pores. The type species of *Barbodes* as designated by Bleeker is *belinka*, known from Sumatra and Malacca. It has the last simple dorsal ray coarsely denticulated, no rostral pores, and no rostral groove.

#### POROPUNTIUS NORMANI, new species

*Description.*—Dorsal and ventral outlines similar; depth 3 in standard length; least depth of caudal peduncle 1.5 in its length and 2 in head; head 4 in length; eye large, close to upper profile, 3.2 in head, equal to snout, slightly less than flat interorbital space; snout obtusely rounded, slightly overhanging the upper lip which is separated from the snout by a deep groove; middle third of snout with a short vertical groove on each side and with transverse rows of pores, a few pores also on snout distal to the rostral groove; mouth strongly arched, lower jaw included, maxillary extending to a vertical from anterior margin of eye; rostral and maxillary barbels equal, as long

as eye; scales large, thin, and marked by numerous longitudinal striae; lateral line complete, moderately decurved; 31 scales in longitudinal series, 5.5–1–4.5 in transverse series, 2.5 rows between base of ventrals and lateral line, 11 between dorsal fin and nape, 14 around narrowest part of caudal peduncle.

Fins: Dorsal origin over base of ventrals, rather nearer to snout than to base of caudal; dorsal rays iii,8; the last simple ray stout, with strong serrations, its length with soft tip 1.5 in depth of body and equal to distance from anterior nostril to posterior border of head, its osseous part equal to head less snout; dorsal margin slightly incised; caudal forked, somewhat longer than head; anal rays iii,5, the unbranched rays weak, longest ray equal to third simple dorsal ray, margin of fin truncate; ventrals and pectorals subequal, 1.25 in head, ventrals with a long axillary scale at base.

Color: Above dull greenish, sides and below silvery, with faint dark longitudinal lines on back and sides following rows of scales; a dark area on posterior part of caudal peduncle; margin of dorsal and caudal dusky, other fins plain.

*Type*.—A specimen 10.5 cm. long taken at Pliew waterfall on Kao Sabap, near Chantabun, Southeastern Siam, April 9, 1925. Cat. No. 90297, U.S.N.M.

*Remarks*.—This species is as yet represented by only the type, which was collected by Luang Masya Chitrkarn, of the Siamese Department of Fisheries. The fish appears to be known to local fishermen and is called *pla kaow*.

I take pleasure in naming this species after Mr. J. R. Norman, in charge of the collection of fishes in the British Museum.

#### BARILIUS KORATENSIS, new species

*Description*.—Moderately elongate, body and head greatly compressed; predorsal profile very slightly elevated, with a minor concavity at nape and a minor convexity on back; depth 3.5 in standard length; least depth of caudal peduncle less than 0.5 head; eye 3.5 in head, 1 in snout, 1 in interorbital space; mouth small, oblique, jaws about equal, maxillary extending to a point under anterior edge of eye; no barbels; lateral line decurved, running in lower half of caudal peduncle; scales in lateral series 34, in transverse series 7 above lateral line, 4.5 below lateral line; 2 between lateral line and base of ventral, 17 before dorsal, 12 around caudal peduncle; scales along middle of side marked by 10 to 12 parallel striae.

Fins: Dorsal rays ii,7, longest branched ray 1.5 in head and more than 0.5 depth of body; origin of dorsal far in advance of anal, midway between base of caudal and anterior fourth of eye, over fourteenth scale of lateral line; caudal longer than head,

deeply forked, lobes pointed; anal rays iii,10, longest less than those of dorsal, and origin under last dorsal ray and under nineteenth scale of lateral line, anal base equal to head less snout; ventrals short, inserted half way between pectorals and anal; pectorals not reaching ventrals, 1.2 in head.

Color: Back pale green, sides and belly silvery; a brownish spot over eye; two narrow black vertical stripes on side, one above pectoral, one below dorsal; fins plain.

*Type*.—A specimen 6.0 cm. long collected in November, 1926, in the Mun River at Tachang, District of Korat, Eastern Siam, by Phra Anuwati, district forest officer. Cat. No. 90298, U.S.N.M.

*Remarks*.—Although only a single specimen of this little fish is at hand, it is said by the collector to be common, going in large schools. This species is principally characterized by the joint fea-

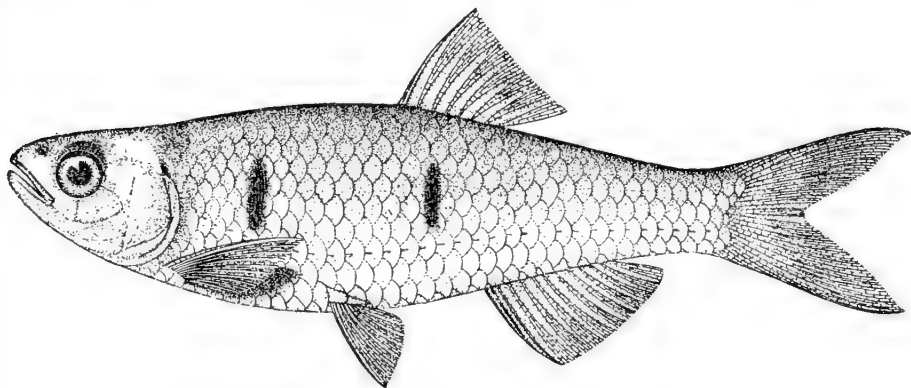


FIGURE 7.—*BARILIUS KORATENSIS*

tures of absence of barbels, comparatively large scales, insertion of dorsal fin almost entirely in advance of anal, and greatly reduced number of vertical stripes on the sides.

***BARILIUS PULCHELLUS*, new species**

*Description*.—Moderately elongate, strongly compressed; ventral profile rather more curved than dorsal; depth 3.4 in standard length; caudal peduncle rather slender, its least depth 0.5 length; head 4 in length; eye 3.3 in head, 1 in snout, 1 in flat interorbital space; circumorbital bones large, the third as wide as eye; mouth very oblique, maxillary extending to a point under anterior part of orbit, lower jaw slightly projecting; 3 rows of large, deep pores covering the entire length of the lower jaw, similar pores on snout and under anterior part of eye; a pair of rostral barbels as long as eye, and a pair of minute maxillary barbels; lateral line rather strongly decurved, running in lower part of caudal peduncle, 38 scales in lateral

series, 7 rows above lateral line, 5.5 rows below lateral line, 3 rows between lateral line and base of ventrals, 22 scales before dorsal, 14 scales around narrowest part of caudal peduncle; scales of back and upper side conspicuously ridged and with fluted edge.

Fins: Dorsal rays ii,8, longest 1.75 times in head; margin of fin convex, its origin over eighteenth scale of lateral line, midway between base of caudal and posterior edge of eye, first branched ray in advance of origin of anal, base of last ray over middle of anal; caudal longer than head, deeply forked, lobes pointed; anal rays iii,11, longest less than first dorsal rays, margin of fin slightly convex; ventrals inserted under eleventh scale of lateral line, shorter than pectorals; pectorals reaching to base of ventrals, the first rays longer than those of dorsal.

Life colors: Back pale sap green, sides and belly bright silvery, belly between pectorals and ventrals orange; side marked by 10 blackish vertically elongate spots, the first at the nape, the spots

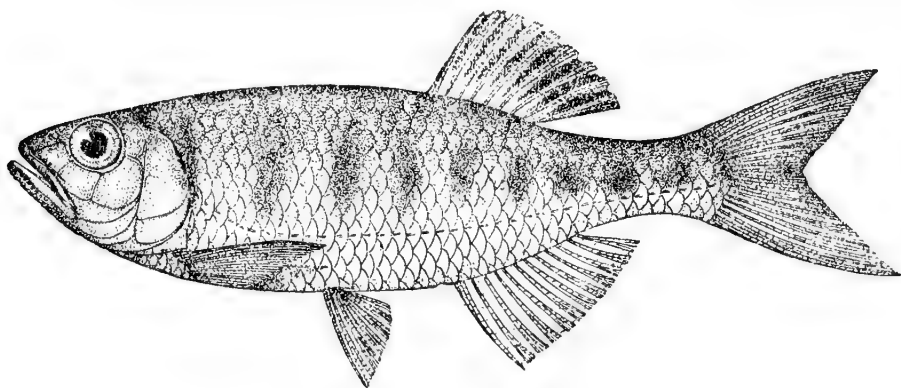


FIGURE 8.—*BARILIUS PULCHELLUS*

becoming roundish on the caudal peduncle; top of head like back, side of head bright silvery; top of snout, muzzle, and margin of upper lip black; iris yellow; dorsal fin orange, with outer two-thirds of membranes jet black; caudal pale green, with dusky edges; anal, ventrals, and pectorals bright orange.

*Type*.—A specimen 7.0 cm. long over all taken on December 1, 1928, in the Mekang at Pang Chao, Northern Siam. Cat. No. 90299, U.S.N.M.

*Remarks*.—This species is as yet known only from 4 specimens taken with a cast net in the Mekang, a beautiful clear, cool, mountain stream on Doi Angka, Northern Siam. The 3 cotypes are similar to the type but show slight variation in the shape and position of lateral spots. The fish is known to the local people, who call it *pla nam muk* (ink fish) and say that it reaches no larger size than these specimens exhibit; one of them contained well-developed ova.

The nearest relative of this species is *B. vagra*, known from India and Ceylon; that, however, is a more elongate species (depth 5 in length instead of 3.4), with rather smaller scales, longer rostral barbel, and only the last two dorsal rays inserted above the anal, whereas in *B. pulchellus* the entire dorsal is above the anal with the exception of the first three rays. In life the species is conspicuous for the jet black areas on the interradi al membranes of the dorsal and the orange-colored lower fins.

The genus *Barilius* has many representatives in India, but only three have previously been recorded from Siam, namely, *B. guttatus*, *B. harmandi*, and *B. ornatus*, the last described by Sauvage from the Menam Chao Phya. Others may be expected from mountain streams near the Burmese frontier.

GARRA TAENIATA, new species

*Description.*—Elongate, slightly compressed, depth slightly less than 5 times in standard length; caudal peduncle long, its depth 0.5 its length; head equal to depth of body; eye 5 in head, 2.5 in snout, 2 in flat interorbital space; snout bluntly pointed, with a marked transverse depression or groove posterior to its tip, the depression sending a shallow branch groove to each nostril and a downward branch which extends to the upper postlabial groove; upper surface of snout as far as eyes thickly beset with sharp horny tubercles, of which one on either side of the tip of the snout is much enlarged; top of head minutely papillate; anterior surface of snout smooth; mouth transverse, twice width of eye; upper lip broad, covered with small, round, soft papillae which are arranged in numerous distinct groups corresponding with the crenululated free margin of the lip; lower lip thickly beset with small, round, fleshy papillae, the suction disk larger than eye, its antero-posterior diameter 0.75 its transverse; rostral barbels longer than eye, maxillary barbels vestigial; lateral line straight, scales in lateral series 35, in transverse series 4.5–1–4.5, in predorsal region 10, between lateral line and base of ventrals 3, around narrowest part of caudal peduncle 12.

Fins: Dorsal rays ii,8; origin of dorsal well in advance of ventrals and midway between tip of snout and posterior end of anal base; free margin of dorsal deeply incised, longest rays longer than head; caudal longer than head, deeply forked; anal rays ii,5, longest less than head; ventrals shorter than pectorals and about length of head.

Color: Back and head parrot green, a broad black band wider than eye from head to base of caudal, a narrow silvery band above it; under parts white; dorsal fin with a medium creamy-yellow band, the basal and distal parts blackish; caudal dusky green; other fins pale apple green.

*Type*.—A specimen 12.8 cm. long taken near the headwaters of Tadi Stream, in Ban Kiriwong, Province of Nakon Sritamarat, Peninsular Siam, July 10, 1928. Cat. No. 90300, U.S.N.M. Paratype No. 90301.

*Remarks*.—This species has been compared with the known forms of *Garra* from India and Burma as represented in the extensive collections in the Indian Museum, Calcutta, and found to be quite different therefrom. The pattern of coloration is especially characteristic.

No species of *Garra* has heretofore been reported from Siam. This fish is not rare in mountain streams in the western part of the Province of Nakon Sritamarat and may be looked for in other mountainous regions of the peninsula. The maximum size attained appears to be about 15 cm. The local Siamese name for the fish in the type locality is *pla lia hin* (stone-lapping fish). All of the fins have the interradiial dermal flanges which are seen in other mountain-stream fishes of India, Burma, and Siam; their significance has not been determined.

**EPALZEORHYNCHUS SIAMENSIS, new species**

*Description*.—Elongate, slightly compressed, greatest depth of body 4.6 in standard length; least depth of caudal peduncle 1.5 in its length and 0.5 depth of body; head small, conical, its length 4.75 in length without caudal; eye 4.25 in head, 2 in snout, 2 in convex interorbital space; a pair of rostral barbels about 0.5 eye, no maxillary barbels; upper lip long, deeply fringed with 15 well-marked sections; lower lip with a few short papillae; scales in lateral line 35, in transverse series 5.5–1–5.5, all scales marked by numerous fine parallel horizontal lines; snout, top of head, and upper lip thickly covered with minute low papillae.

Fins: Dorsal fin in anterior half of total length, over ventrals, dorsal rays iii, 8, the longest ray exceeding depth of body; basal part of dorsal rays with fleshy flanges; caudal fin much longer than longest dorsal rays, deeply forked, lobes pointed; anal origin midway between ventrals and base of caudal, rays ii, 5, longest branched ray equal to depth of body over anal fin; ventrals and pectorals short, subequal.

Color (in life): Back and sides green with flecks of light blue or purple; top of head bright green; a black lateral band as wide as eye from head to base of caudal, continued to tip of middle caudal rays; a narrow, silvery lateral band below the black band; under parts white; dorsal, caudal, and pectorals very pale green; anal and ventrals hyaline.

*Type*.—A specimen 13.8 cm. long caught July 14, 1928, in a dipnet in the upper part of Tadi Stream, a mountain rivulet flowing

eastward into the Gulf of Siam through the town of Nakon Sritamarat, Peninsular Siam. Cat. No. 90302, U.S.N.M.

*Remarks.*—This genus has heretofore been known from a single species, *E. kalopterus* (Bleeker), found in rivers in Sumatra and Borneo where Bleeker reported it to be not rare. It is characterized, among other features, by having two pairs of barbels whose length is about equal to diameter of eye, and by having on the dorsal and anal fins a broad black band, and on the ventrals a large black area which may involve the entire fin. Its maximum length is 16 cm.

The Siamese fish presents such differences from the East Indian form that it seems best to describe it and give it a name. The two are similar in general shape, in squamation, in fin formulae, and in having a broad dark band extending from the snout to the tip of the middle caudal rays; but the Siamese form has no vestige of maxillary

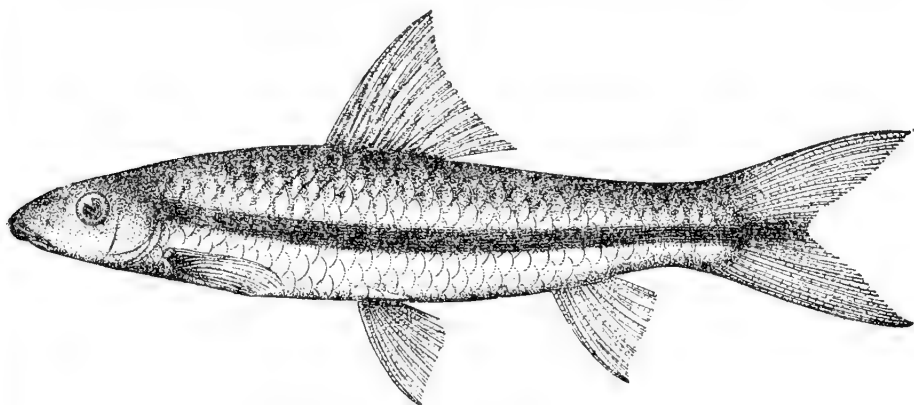


FIGURE 9.—*EPALZEORHYNCHUS SIAMENSIS*

barbels, there are fewer scales in transverse series, and the dorsal, anal, and ventral fins have no black whatever.

The absence of maxillary barbels requires a modification of the definition of this genus.

Although only a single specimen was obtained in the upper waters of Tadi Stream, the fish is apparently known to the fishermen, who report that it reaches no larger size than the type and is good to eat. A name borne by no other fish is applied to it, *pla lab mue nang* (lady's finger-nail fish).

#### SCAPHOGNATHUS, new genus

Body deep, strongly compressed, abdomen rounded; snout partly covering upper lip and with a small lateral groove; mouth small, terminal, the lips continuous around corners of mouth; lower lip confined to the sides, the median portion of the lower jaw being a slender, sharp-edged, scoop-like process overhung by the upper lip

when mouth is closed; no barbels; branchial membranes broadly united to isthmus, branchial apertures not reaching to below preopercle; scales large, lateral line complete; all fins well developed; dorsal fin long, last simple ray osseous, stout, denticulated, branched rays numerous; last simple anal ray osseous, stout, branched rays 6.

This genus presents a combination of characters which serve to distinguish it readily. The outstanding features are the very deep and compressed body; the highly modified lower jaw with the lips restricted to the sides and the central part forming a strong, slender, sharp-edged scoop; the strong, osseous, denticulated last simple ray in the dorsal fin; the numerous branched dorsal rays; and the presence of a strong, osseous, untoothed simple ray in the anal fin.

In some members of the Bleekerian genus *Sarcocheilichthys* from eastern Asia, the lower jaw is somewhat similar to that in *Scaphognathus*, but the median lipless part is much less developed and not scoop-like, and the mouth is inferior; moreover, the last simple dorsal ray is not strongly osseous and not denticulated.

**SCAPHOGNATHUS STEJNEGERI, new species**

*Description.*—Body ovate, strongly compressed, depth 2 in standard length; greatest width of body about 0.25 depth and equal to snout and eye; dorsal profile strongly arched, a slight concavity at nape; back anterior to dorsal fin compressed to a moderately sharp ridge; head short, compressed, bluntly pointed, 4.35 in length, its depth somewhat less than length; snout short, a vertical groove on each side, a few inconspicuous pores on lateral part in line with lower edge of orbit; eye large, prominent, inclined outward and downward, less than snout, 3.5 in head, 1.8 in convex interorbital space, a free orbital rim; mouth terminal, maxillary not reaching vertical from anterior margin of eye, gape narrow, upper lip partly covered by snout and separated therefrom by a deep fold continued around the corners of mouth and coterminous with lower lip; lips rather thin, continuous, lower lip on each side occupying one-third the width of jaw and deficient medianly; a long, slender, bony, sharp-edged, scoop-like process occupying the middle of lower jaw, its width much less than that of mouth, its length two-thirds diameter of eye; no barbels; caudal peduncle short, broad, its least depth less than its length and equal to snout and eye; lateral line gently decurved, running in middle of caudal peduncle; scales thin, smaller on caudal peduncle and thorax, 28 or 29 in lateral series, 6.5–1–4.5 in transverse series, 3.5 rows between lateral line and base of ventrals, 12 in predorsal region, and 16 around narrowest part of caudal peduncle; a deep scaly sheath at base of anal.



Fins: Dorsal formula iv,14; origin of dorsal over ninth and tenth scales of lateral line, slightly posterior to that of ventrals, and midway between tip of snout and base of middle caudal rays; dorsal emarginate, the branched rays becoming gradually shorter, last ray slightly produced, shortest ray one-third length of first; fourth simple dorsal ray denticulated, very stout and strong, its length with soft tip 1.6 in depth of body; length of dorsal base 1.6 times head; caudal fin broad, forked, lobes pointed, length of fin nearly equal to dorsal base; origin of anal under seventeenth scale of lateral line, anal rays iii,6, third simple ray osseous, strong, its length less than that of similar dorsal ray, border of fin rather deeply emarginate, the last ray 0.4 length of first branched ray; ventrals extending beyond vent, equal to pectorals and somewhat shorter than head.

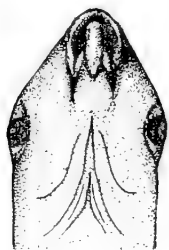


FIGURE 10.—UNDER SIDE OF HEAD OF SCAPHOGNATHUS STEJNEGERI

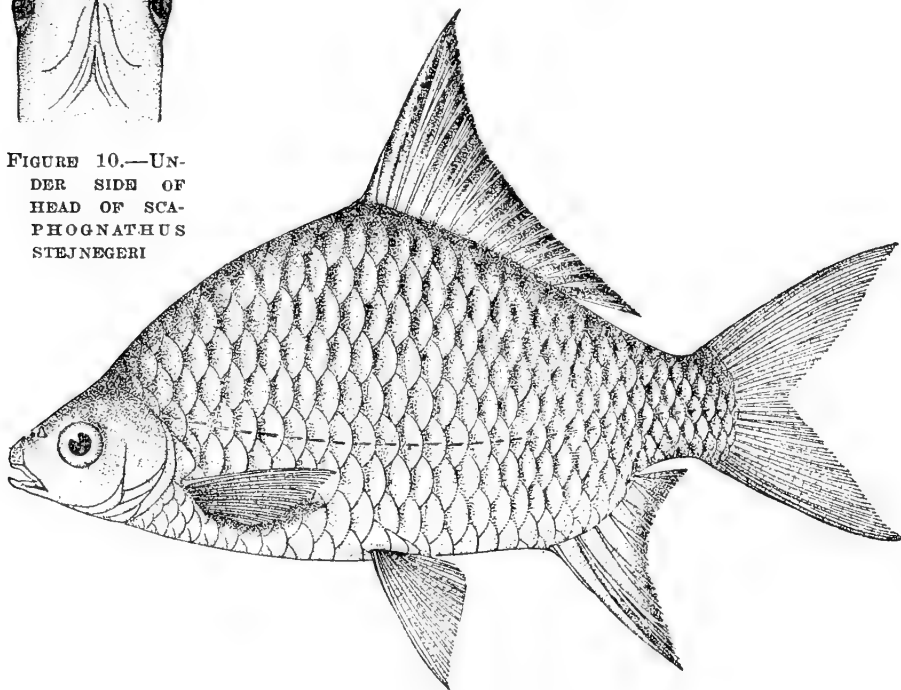


FIGURE 11.—SCAPHOGNATHUS STEJNEGERI

Color: Silvery, black pale green, scales of back and sides with dark green base.

*Type*.—A specimen 22.5 cm. long taken in the Mekong River near Ban Mekong, Northeastern Siam, February 24, 1929. Cat. No. 90303, U.S.N.M.

*Remarks*.—This species is apparently rare. In extensive collecting in the Mekong where it forms the boundary between Siam and French Indo-China, only a single specimen was obtained.

Named in honor of Dr. Leonhard Stejneger, head curator of biology in the United States National Museum.

## MYSTUS HAVMOLLERI, new species

*Description.*—Dorsal profile rather steep, sloping in a straight line from dorsal fin to rounded overhanging snout; depth 4 in standard length; caudal peduncle rather stout, its narrowest part 1.5 in its length and equal to postorbital part of head; head conical, as broad as high, its length 1.5 its breadth and equal to depth of body; skin of head smooth, a shallow median fontanelle extending from between eyes to base of slender occipital process, which reaches interspinous bone of dorsal; eye small, 5 in head, 2 in snout, nearly 2 in convex interorbital space; mouth horizontal, its width 1.5 eye; a narrow band of teeth in jaws and on palate; nasal barbels extending as far as eyes, maxillary barbels 0.6 length of head, mandibular barbels somewhat longer than nasal, mental barbels shorter; a transverse row of 4 large pores behind lower lip; entire snout thickly beset with minute pores.

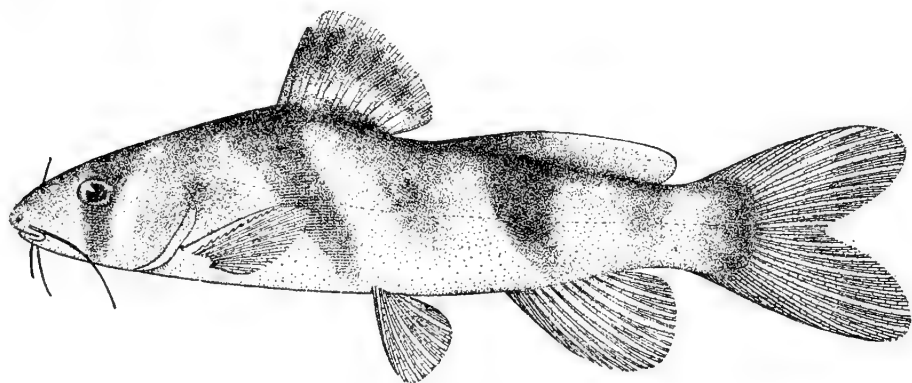


FIGURE 12.—MYSTUS HAVMOLLERI

Fins: Dorsal rays i,7; margin of fin convex; origin of fin midway between tip of snout and origin of anal; dorsal spine short, stout, without teeth, its length less than half depth of body and equal to postorbital part of head; adipose fin separated from dorsal by a space equal to eye, its height 0.5 that of caudal peduncle, its length about 2 times dorsal base; caudal broad, deeply forked, the lobes broadly rounded and somewhat shorter than head; anal rays iii,10, entirely under adipose, margin rounded, rays longer than longest dorsal rays; ventrals short, inserted under two last dorsal rays; pectorals longer than but not reaching ventrals, the stout spine longer than dorsal spine and strongly denticulated on posterior edge.

Color: General color light yellowish-brown; body and head marked by 7 irregular dark brown cross-bands: (1) from top of head, through eye, across cheek, (2) from nape obliquely to lower part of opercle, (3) from back in front of dorsal fin obliquely downward and backward nearly to ventral base, (4) broad-based, triangular, from back

under posterior part of dorsal and anterior end of adipose to below lateral line, (5) similar, from anterior half of adipose nearly to anal base, (6) narrow, vertical, across caudal peduncle at posterior end of adipose, and (7) across base of peduncle, the first, third, fifth, and seventh bands most distinct; dorsal fin with a dark brown base and a broad band on distal part extending its entire length and leaving a clear narrow margin; fins otherwise plain.

*Type and paratypes.*—The type is 5.2 cm. long, collected in January, 1927, in Klong Thalerng, near Ronpibun, Peninsular Siam. The paratypes number 6, and range in length from 4.1 to 5.2 cm. Cat. No. 90304, U.S.N.M.; paratypes, 90305.

*Remarks.*—This strikingly marked little fish is known only from the type locality.

This species is named for Mr. R. Havmöller, who collected the type and cotypes, and has presented numerous other interesting specimens to the Siamese Department of Fisheries and the United States National Museum.

**PANGASIUS CULTRATUS, new species**

*Description.*—Elongate, body greatly compressed and deep, ventral profile much more arched than dorsal, dorsal profile from snout to dorsal fin slightly elevated and nearly straight; abdomen compressed to a sharp edge along entire median line; depth of body at anal origin 3.6 in standard length, the thickness 3.25 in depth, least depth of peduncle about equal to postorbital part of head; head short, 5 in body length, moderately compressed, its greatest width 1.5 in length and about equal to its depth; snout short, blunt, broadly rounded, slightly less than eye; eye large, 3.5 in head, rather more than 2 in the strongly convex superior interorbital space and less than 2 in the inferior interorbital space; eye scarcely visible from above, its middle behind corner of mouth, its anterior margin separated from mouth by a space equal to 0.5 eye; mouth subterminal, crescentic, its width 1.5 times eye; teeth in jaws in a narrow band, on vomer in well-separated horizontally ovate patches, on palatines in smaller oblique patches which form a crescent with those on vomer; maxillary barbels, attached behind corner of mouth, occupy a deep groove, extend slightly behind eye, and are much less than 0.5 head; mandibular barbels less than 0.5 maxillary barbels; skin of head minutely granular, no obvious median fontanel; occipital process long and slender.

Fins: Dorsal formula ii,6, the spine equal to head minus snout, slender, laterally compressed, finely serrated on posterior edge, longest soft rays 2.5 times length of dorsal base; adipose fin small, slender, less than diameter of eye, its insertion over last fifth of anal fin; caudal broad, forked, somewhat longer than head, the lobes obtusely pointed; anal rays iv,39, the long base of fin con-

tained 2.8 times in standard length; ventrals small, shorter than pectorals, inserted well above the median line; pectorals about equal to dorsal, the spine slender and finely serrated on posterior edge.

Color: Back and top of head rich grass green; sides and under parts white; from the green color of the anterior back a tapering green band extends backwards along lateral line for about half length of body, and below this a shorter, broader green band extends backwards and downwards; fins mostly hyaline, caudal green at base, anal pinkish.

*Type*.—A specimen 26.0 cm. long over all, 22.5 cm. to base of caudal, taken in a cast net in the Tapi River near Bandon, Peninsular Siam, September 30, 1923. Cat. No. 90306, U.S.N.M.; paratype, 90307.

*Additional specimens*.—Four other specimens are referred to this species: Two 14.5 and 15.5 cm. long caught in a cast net in the Sikuk River, Central Siam, November 16, 1923, another 17.0 cm. long taken in a seine in the Menam Chao Phya at Bang Sai, November 17, 1923, and a fourth 18 cm. long, in the Menam Chao Phya at Bang Sai, September 12, 1924.

*Remarks*.—From related species this form may be distinguished by its greatly compressed form, cultrate abdomen, large eye, short maxillary barbel, four patches of teeth on vomer and palatines, and very long anal with more numerous rays than in any other known species. The most closely related species appears to be *P. micronema* Bleeker, from Java, Sumatra, and Borneo, in which the depth is less, the eye is smaller, the anal base is much shorter, and the anal rays are iv,25 to iv,30. In *P. pangasius* (Buchanan), known from India and Burma, and also Siam, the form is comparatively slender (depth 4.6 to 5 in length), the maxillary barbels may reach the pectorals, and the anal rays number only iv,26 to iv,29.

This fish is known as *pla sangkawad* at Bandon. This name, with or without qualifying adjectives, is applied in various parts of Siam to other members of the genus. The additional specimens, from the Chao Phya and Sikuk rivers, are also locally called *pla sangkawad*.

#### PANGASIUS BEANI, new species

*Description*.—Form rather stout, the body compressed and deep, the head depressed and very broad; profile before dorsal fin straight and markedly elevated, forming an angle of 30° with horizontal axis of body; depth of body under dorsal spine 3.5 in standard length, over origin of anal 4.3 in length; caudal peduncle short, its least depth less than 2 in its length; head 3.5 in standard length, its width 0.75 its length and more than its depth; upper surface of head rugose, a shallow median groove extending from snout to base of

occipital process whose base is 0.5 its length; snout very broad, rather pointed when viewed from side, evenly rounded, slightly overhanging the horizontal mouth, whose width at corners is 4 times diameter of eye; teeth in jaws villiform, in a well curved band with a median division in each jaw; teeth on vomer in a single quadrate patch whose length is nearly 3 times its antero-posterior diameter, elongate patches of palatine teeth slightly separated from the vomerine and forming therewith a regular crescentic band; eye small, partly below the corner of the mouth, nearly 7 in head, 4.5 in the convex superior interorbital space, and 4 in the inferior interorbital space; maxillary barbel arising in a deep groove above corner of mouth and extending to opercle, its length less than 0.5 head, mandibular barbel shorter, 2 times diameter of eye.

Fins: Dorsal formula ii,7; dorsal spine serrated on posterior edge, its length about equal to head less snout, its filamentous prolongation as long as spine; length of first branched ray 2 times base of fin; adipose fin about 2 times as high as long, its origin about over the beginning of the second half of the anal base; caudal deeply forked; anal rays iv,26, the longest branched rays more than 0.5 base of fin, which is contained 4 times in standard length; ventrals inserted far behind dorsal, shorter than pectorals, the first ray produced and reaching well beyond anal origin; pectoral spine strongly serrated on posterior edge, somewhat shorter than dorsal, the longest branched ray 1.5 head.

Color: Dark green above, white below; dorsal and caudal dusky, other fins plain, anterior anal rays with a black tip.

*Type*.—The type, 16.3 cm. standard length, 20.0 cm. over all, was taken November 26, 1923, in Klong Ban Poh, off Lopburi River, near Ayuthia, Central Siam. Cat. No. 90308, U.S.N.M.

*Remarks*.—This species is easily recognized by its extremely broad, depressed head, its comparatively short form, its small eye, its short barbels, its dentition, etc. Its nearest relative appears to be *P. pangasius* (Hamilton Buchanan), known from India, Siam, and Java. In that species, however, the body is more elongate, the head narrower, the barbels are longer (the maxillary extending to base of pectorals), the profile from snout to dorsal fin is much less steep, the anal base is comparatively longer, and the vomerine teeth form two separate patches except in full-grown specimens. In the plates of *P. pangasius* published by both Day (Fishes of India) and Bleeker (Atlas Ichthyologique), the vomerine teeth are in two distinct patches.

This species is named for Mr. Barton A. Bean, assistant curator in charge of the division of fishes in the United States National Museum.

**PANGASIUS FOWLERI, new species**

*Description.*—Moderately elongate; body rather strongly compressed, its width at origin of anal fin slightly more than one-third its depth, depth 3.75 in standard length; caudal peduncle twice as long as deep, its least depth equal to distance from eye to pectoral spine; head covered with smooth skin, short, blunt, conical, its length about 5 in standard length, its greatest width equal to its depth behind eyes; snout obtusely rounded; mouth opening subterminal, slightly angular, distance between corners 2.5 times in length of head; teeth in upper jaw in a wide, moderately curved, rather broad band, in lower jaw in a more strongly curved band, vomerine teeth in two well-separated transverse ovate patches, with the somewhat longer palatine patches perpendicular thereto; maxillary barbels less than 0.5 length of head, occupying a deep slit that extends from corner of mouth to beyond eye; mandibular barbels about 0.5 length of maxillary; eye large, behind corner of mouth, shorter than snout, its upper margin on a line from anterior nostril to middle of caudal base, its diameter more than 3 in the strongly convex interorbital space; ventral distance between eyes less than dorsal.

Fins: Dorsal rays ii,7; height of dorsal equal to head less snout, its base 0.5 height; dorsal spine rather strong, 1.5 in head, its posterior border strongly serrated, anterior border feebly serrated at tip and granulated at base; adipose fin small, slender, equal to eye, its attachment over the beginning of the last fourth of the anal; caudal deeply emarginate, the lobes pointed; anal long, its rays iv,38, length of anal base contained less than 3 times in standard length, longest anal rays one-third head; ventrals short, less than 0.5 head, not extending to anal; pectoral rays slightly longer than dorsal, the spine equal to dorsal spine and similarly serrated but more slender.

Color: Back and top of head green; sides and belly white; a lateral green band broadest at shoulder, and a broad oblique green band from shoulder to a point on side above end of ventrals; dorsal and caudal fins with dusky margin, other fins plain.

*Type.*—A specimen 17.0 cm. to base of caudal, 19.5 cm. over all, taken in the Lopburi River at Lopburi, Central Siam, October 22, 1926. Cat. No. 90309, U.S.N.M.

*Remarks.*—The closest relative of this species appears to be *P. micronema* Bleeker, known from Java, Sumatra, and probably Siam. In that fish, however, the vomero-palatine teeth form a regular crescent, the band of upper jaw teeth is less curved, the anal rays number iv,24 to iv,30, the anal base is contained 3.6 to 4 times in standard length, and the coloration is different.

The fish at Lopburi shares with related forms the name *plawsawai*. The collection contains only the type specimen.

This species is named for Mr. Henry W. Fowler, of the Academy of Natural Sciences of Philadelphia, as a small tribute to his indefatigable studies of oriental fishes.

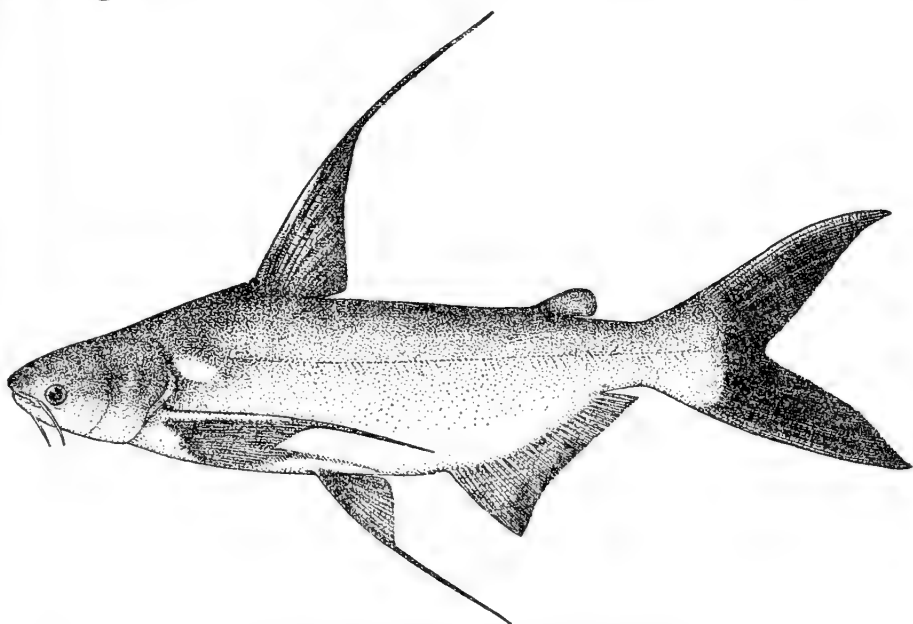


FIGURE 13.—PANGASIUS SANITWONGSEI

PANGASIUS SANITWONGSEI, new species

*Description.*—Elongate, body moderately compressed, head broad and depressed; dorso-rostral profile nearly straight and gently inclined; depth 3.75 in length to base of caudal; head 4.3 in length; eye placed low on side of head, small, more than 7 in head, 3 in snout; maxillary teeth in a wide, continuous curved band, vomeropalatine teeth united into a single broad strongly arched band with the outer part nearly at right angles to the central vomerine mass and tapering backward into sharp points; barbels slender and rather short, the maxillary 2.5 times diameter of eye, the mandibulary shorter; least depth of caudal peduncle 0.5 its length and contained 2.75 times in length of head.



FIGURE 14.—MAXILLARY AND VOMEROPALATINE TEETH OF PANGASIUS SANITWONGSEI

*Fins:* Origin of dorsal fin about midway between tip of snout and adipose fin; dorsal rays ii,7; second simple dorsal ray greatly prolonged and filamentous, 0.5 combined length of head and body, the

strong osseous part weakly serrated on its posterior side and 0.4 total length of the ray; dorsal branched rays becoming progressively shorter, so that last ray is only 1.5 times diameter of eye and the posterior border of fin is nearly vertical; dorsal base short, 2.5 in head; adipose fin small, its length less than base of dorsal, distance between the fins 3 times length of base of dorsal; caudal large, longer than head, deeply forked, the lobes pointed; anal rays iv, 26, longest ray equal to postorbital part of head; base of fin 2.5 base of dorsal and somewhat less than 0.25 standard length; first ray of ventrals filamentous and reaching beyond middle of anal; pectoral spine similar to dorsal spine as to size and serrations, its filamentous tip as long as the spine and extending to anal.

Color: Above slaty gray, below white; a roundish, glistening white humeral spot twice diameter of eye; dorsal, adipose, and caudal fins black; ventrals and pectorals blackish; anal with dusky areas.

*Type*.—The type specimen in the collection of the Siamese Department of Fisheries was taken in the Menam Chao Phya at Koh Yai, Central Siam, March, 1928. It is 61.6 cm. long.

*Remarks*.—The principal differential characters of this species are to be seen in the united band of vomero-palatine teeth, the short barbels, the filamentous dorsal, ventral, and pectoral fins, the coloration of the fins, the white humeral spot, and the colossal size.

This fish is known along the Menam Chao Phya as *pla tepa*. This name is to be distinguished from *pla tepo*, applied to a common fish of the same genus (*Pangasius larnaudi*) which differs markedly in various respects, one striking feature being a large shiny-black humeral spot.

In point of size this fish rivals the celebrated *Pangasius* of the Mekong basin called *pla buk* by the Siamese. In former times fish 3 meters in length were sometimes taken, and at least one fish of this size has been recorded within eight years. In recent years, examples over 1.5 meters in length have been rare.

The *pla tepa* frequents the entire length of the Menam Chao Phya, but is nowhere abundant. Within a few years, fish reaching the Bangkok markets have come mostly from the section of river below Ayuthia, and the largest observed have been about 1 meter long.

Named in honor of the late Dr. Yai S. Sanitwongse, in recognition of his keen personal interest in the fishes of Siam. It was he who first brought this species to the writer's attention and pointed out its distinctive characters.

ARIUS SCIURUS, new species

*Description*.—Body rather stout, moderately compressed, depth slightly less than .25 length to base of caudal; least depth of caudal peduncle .5 postorbital part of head; head conical, its depth about



equal to its breadth, its length about 3.3 times in body length; rostrum-dorsal profile convex, the snout strongly decurved and obtusely pointed viewed from above; cephalic shields only slightly rugose, occipital process granular, strongly keeled, subtriangular, its base somewhat less than length, the posterior end rounded; a shallow lanceolate fontanel extending from above posterior nostrils to base of occipital process; eye lateral, in anterior half of head, more than 5 in head, more than 1.5 in snout, 2.5 in postorbital region, and 2.8 in interorbital; mouth rather small, its width 2 times diameter of eye; humeral process smooth, less than eye; maxillary barbels slender, short, extending 1 eye-diameter beyond eye; mandibular barbels reaching less than .5 distance to posterior margin of branchial membrane; mental barbels shorter; teeth in upper jaw in a medianly-constricted band about 3 times as long as broad, palatine teeth large molar-like, in 2 large suboval patches; gill-rakers short, club-like, 9 on lower arm of first arch, the longest one-third diameter of eye.

**Fins:** Dorsal rays i,7, height of fin greater than depth of body and equal to distance from posterior nostril to branchial aperture, base of fin much less than 0.5 its height, spine very slender, longer than head without snout, serrated distally on both anterior and posterior surfaces; base of adipose fin equal to base of soft dorsal and separated from dorsal by 2.5 times its length; caudal deeply cleft, the lobes acute, the upper lobe longer; anal rays iv,14, the longest equal to height of body at anal origin and somewhat longer than base of fin, the posterior edge emarginate; ventrals less than .5 length of head; pectorals about equal to head without snout, the slender spine less than dorsal spine and serrated on both edges.

**Color:** Back and sides light slaty-blue, belly silvery; fins yellow-green, dorsal with a blackish margin, anal dusky, adipose with a black spot.

**Type.**—A specimen 25 cm. long over all, 21 cm. to base of caudal, taken with a castnet in the Tapi River near Bandon, Peninsular Siam, September 30, 1923. The fish is a male, with the buccal and pharyngeal cavities filled with eggs in an advanced stage of development whose long diameter is 1.4 cm. and short diameter 1.2 cm. Cat. No. 90310, U.S.N.M.

**Paratype.**—Another specimen, 25.5 cm. long over all, 21.5 cm. to base of caudal, taken at the same place and date, is a male with five young, 4.0 cm. long, in the back of the pharynx.

**Remarks.**—This is a very common fish in the Tapi River where it is said to attain a length of 1.5 meters. Examples in the Bandon market on September 29, 1923, were 60 cm. long. Eggs of this fish, separately exposed for sale, had been removed from the mouth of large males in an agglutinated mass looking like a bunch of grapes.

Some of the clusters were 18 cm. long, and the eggs were nearly 1.5 cm. in long diameter. At an early stage of incubation the eggs are coherent, but some time before hatching they become entirely separate. The palatine teeth on elevated bases project conspicuously into the cavity of the mouth, and may serve to assist in keeping the eggs in the back of the pharynx.

The nearest relative of this species appears to be *A. microcephalus* Bleeker, known only from 2 specimens from rivers of Borneo. That species, however, has a smaller head much broader than high, longer maxillary barbels, much stouter dorsal and pectoral spines, etc.

The conical head, large eye, and pointed snout suggest a squirrel, and the specific name has been applied in allusion to this resemblance.

**SYNAPTURA AENEA, new species**

*Description.*—Broadly ovate; depth of body 1.8 in standard length, 2.12 in length with caudal; head broad, evenly rounded in front, its length 3.8 in standard length, 4.6 in length with caudal; mouth

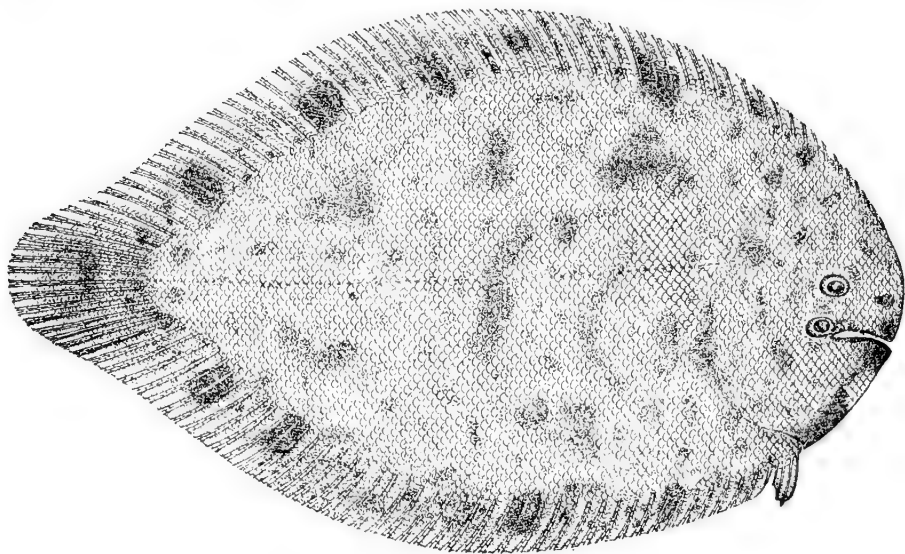


FIGURE 15.—*SYNAPTURA AENEA*

slightly curved, rictus about one-third length of head, angle extending below anterior port of lower eye; two small tubular nostrils in advance of lower eye; nostril on under side dilated and having a flap; lips on upper side sparsely, on lower side markedly, fringed, and nostril on under side surrounded by long fringe; upper eye slightly anterior to lower, 2 in snout, 6 in head, and greater than interorbital space; teeth very minute; lateral line straight on both sides of body; scales small, strongly ctenoid on dextral side, less so on sinistral side, 66 in lateral line, about 32 rows above and 35 rows below lateral line at widest part of body; rays in vertical fins 115,

dorsal having 54, anal 45, and caudal 16, median caudal rays longer than head without snout and longer than longest dorsal and anal rays; ventral rays 4; dorsal rays not extending on snout; pectoral on each side rudimentary.

Color: Upper side light brown, with numerous spots of darker brown of irregular side and shape on body and head; anterior margin of head between mouth and gill opening blackish, with a well defined rounded white spot on chin; vertical fins, in addition to having small, irregular dark brown spots, marked by 4 large roundish well-defined blackish spots on proximal part of both dorsal and ventral fins, these spots more than twice diameter of eye; under side of body rich reddish-brown, becoming less intense toward head which is white except for a dark area about mouth and on chin below white spot on dextral side.

*Type*.—A specimen 9.4 cm. long taken in the Lopburi River at Lopburi, Central Siam, October 22, 1926. Cat. No. 90311, U.S.N.M.

*Remarks*.—This species is not rare at Lopburi but as yet is known only from that locality. The maximum size attained is but little if any larger than the type. In a second specimen, 8.4 cm. long taken at the same time and place as the type, the brown markings have a tendency to form vermiculations, and the bronze color of the left side stops some distance behind the head, leaving more than half of under surface white. In the reduction of the pectorals to mere rudiments, this species shows a transition from *Synaptura* to *Achiroides* in which latter genus the pectorals are entirely absent.

#### GOBIELLA, new genus

Similar to *Mistichthys* H. M. Smith, known only from a mountain lake in Luzon, Philippine Islands, but with the first dorsal fin containing five spines instead of three. Size minute; body elongate, strongly compressed posteriorly; mouth moderate, oblique; teeth in bands; body posteriorly covered with large ctenoid scales, head and anterior part of body scaleless; dorsal fins well separated, the anterior with five short spines, the posterior dorsal and the anal fins elevated and with moderate number of rays.

#### GOBIELLA PELLUCIDA, new species

*Description*.—Elongate, head and anterior part of body very slightly compressed, posterior part of body much compressed; depth under first dorsal fin equal to head less snout and contained 3.8 times in standard length; head comparatively large, 3.3 in length; eye in anterior half of head, large, 4 in head and much greater than the blunt snout; mouth very oblique, maxillary extending to a point

under pupil; minute teeth in bands in each jaw; caudal peduncle long and slender, its least depth 3 in its length; scales large, weakly ctenoid, absent from head and from body anterior to first dorsal, 8 rows of scales in transverse series below origin of second dorsal, 9 scales around narrowest part of caudal peduncle.

Fins: Dorsal fins widely separated, the interspace greater than length of base of first dorsal; dorsal rays V-I, 8; spinous dorsal low, the spines close together, the first spine longest and about equal to snout and eye, the other spines progressively shorter, the last 0.75 eye; second dorsal much elevated, its origin nearer to base of caudal than to eye, the first ray equal to postorbital part of head, the first branched ray longer than spine and equal to body depth at dorsal origin, the rays becoming gradually shorter, the last ray as long as the last dorsal spine; caudal broad, its posterior edge straight and vertical, the length along axis of body equal to height of second

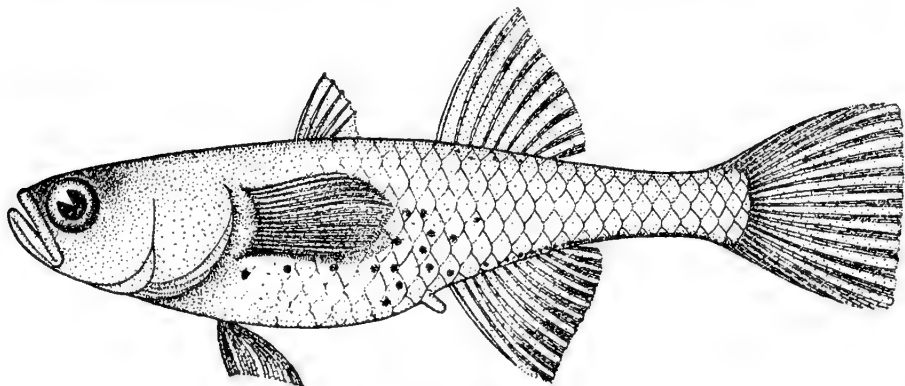


FIGURE 16.—*Gobiella pellucida*

dorsal and greater than postorbital part of head; anal rays I, 11, the fin similar to second dorsal, but the rays slightly shorter and base slightly longer and its origin posterior to that of second dorsal; ventrals 2 in head, forming a deep cup; pectorals broad, bluntly pointed, their length equal to longest anal ray, their tip reaching to a point halfway between the dorsal fins.

Color: White, translucent; a few irregularly disposed small round black spots on sides and abdomen; a row of minute black spots at base of anal; fins hyaline.

*Types*.—Numerous specimens taken on May 9, 1929, in Bangkok, Central Siam. Cat. No. 90312, U.S.N.M.

*Remarks*.—This diminutive goby has as yet been found only in Bangkok, but may doubtless be looked for anywhere in lower Central Siam. Its only known habitat is a small canal or ditch and a small pond in the grounds of the Department of Fisheries; the pond and canal are ultimately connected with the Menam Chao Phya. The

fish is abundant, but owing to its small size and translucency is easily overlooked.

Collections made from January to May contain egg-bearing females, and it appears that the egg-laying period is protracted and may extend over most of the year. An ovigerous female 2.1 cm. long taken February 10, 1928, contained 238 eggs with an average diameter of .64 mm.

The sexes may be readily distinguished by the shape of the genital papilla: short, broad, and truncate in the female, long, slender, and pointed in the male, as in *Mistichthys* and various other gobies. The eggs are clearly visible through the transparent abdominal walls. If there is a difference in the average size of the male and female fish it is not marked. Thus, of 16 specimens collected January 19, 1929, 13 were females ranging from 18 to 21 mm. in total length, with an average of 19.8 mm., and 3 were males ranging from 18 to 21 mm., with an average of 20 mm. The numerical disproportion of the sexes is shown from other collections, as, for example, on May 9, 1929, when, of 40 examples taken at random in a fine-mesh basket, 30 were females.

#### THAIGOBIELLA, new genus

Size minute; body moderately elongate; mouth large, lips thin, tongue emarginate; teeth pluriserial; eye large and placed high on head; two dorsal fins well separated, the first with 5 spines, the second with 8 branched rays; anal similar to second dorsal; ventrals not adnate to abdomen, and united for their entire length, forming a deep cup; pectorals without silky, free upper rays; body completely covered with large scales, opercles scaled, cheeks and other parts of head naked.

This genus most closely resembles *Vaimosa* Jordan and Seale the members of which inhabit brooks in the South Sea islands and Philippines. It differs therefrom in the reduced number of dorsal and anal rays, in the character of teeth and scales, in the size of head, etc.

(*Thaigobiella*, from Thai, the ancient name of the Siamese race, and *gobiella*, little goby).

#### THAIGOBIELLA SUA, new species

*Description*.—Form oblong, moderately compressed; dorsal and ventral profiles nearly horizontal, the profile of snout steep; depth 4.4 in length; caudal peduncle very broad, two-thirds depth of body and 2.25 times in head; head long, 3 in length; mouth large, very oblique, extending to a point under anterior margin of pupil, lips thin; teeth long, slender, prominent, in a band in each jaw with a few enlarged teeth interspersed; eye placed high, 3 in postorbital part of head, about equal to snout and to interorbital space; scales,

large, strongly ctenoid, smaller on anterior part of body, opercles scaled, cheeks and nape naked; 26 scales in lateral line, 11 in transverse series below second dorsal, 12 around caudal peduncle.

Fins: Dorsal rays V-I, 8; dorsal spines slender, the third longest, more than 0.5 depth of body, and equal to base of fin; second dorsal separated from first by a space equal to diameter of eye, longest rays equal to depth of caudal peduncle; caudal short, broad, bluntly pointed; anal under second dorsal and similar thereto, the rays I, 8; ventrals long, longer than pectorals and equal to postorbital part of head; pectorals short, broad, 0.5 head, extending to a point under last membrane of spinuous dorsal.

Life color: General color, pale creamy yellow; body with 4 irregular black crossbands, the first under the first dorsal and as wide as its base, extending nearly to median line below; the second narrower,

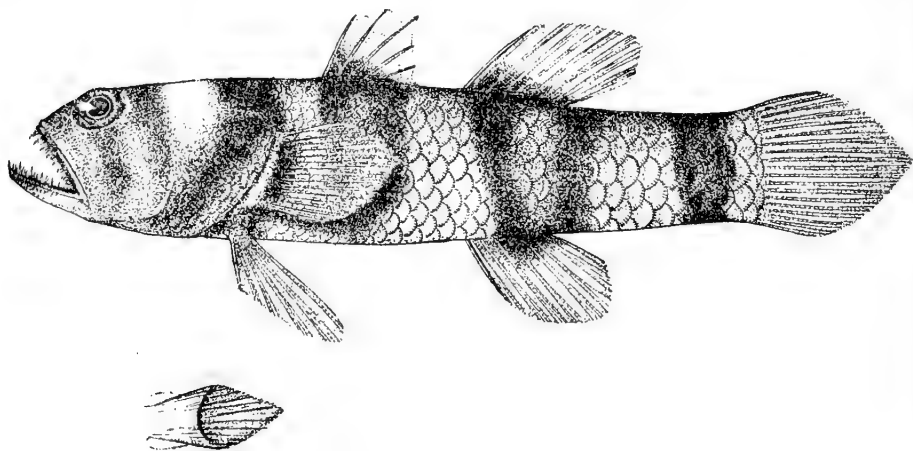


FIGURE 17.—*THAIGOBIELLA SUA*

extending from anterior half of base of second dorsal obliquely downward and backward to posterior part of anal; the third narrow and extending vertically posterior to second dorsal and anal; the fourth, the most intense, running vertically across posterior part of caudal peduncle at a distance of half its width from caudal fin; a blackish band across nape and posterior part of head, another extending downward from median line of head posterior to eye, and another under eye; top of head between nuchal and postorbital bands glistening white; margins of lips and orbits black; base of pectorals with a very sharply defined black vertical blotch; base of dorsal and anal fins black, fins otherwise hyaline.

*Type*.—A specimen 2.7 cm. long from a canal in Bangkok, Central Siam, August 26, 1924. Cat. No. 90315, U.S.N.M.

(*Sua*, the Siamese name for the tiger.)

*Remarks*.—This attractive but diminutive goby is as yet known from a single specimen. It was kept alive in a small glass jar for

six weeks. It usually remained either in the bottom well concealed among particles of sticky mud, or beneath the roots of a small natant water plant.

**POGONOGOBIOUS, new genus**

Body compressed; head greatly depressed, broad and flat, with small eyes widely separated; mouth large, nearly horizontal, lower jaw slightly projecting, gape extending to a point under eye and jaws projecting backward almost to preopercle; small teeth, in several rows in each jaw, none canine or markedly enlarged; tip of tongue rounded; about eight short, fleshy barbels on each side of snout, one large pair on chin near median line and one pair on each side of the lower jaw in line with the tubular anterior nostrils; body covered with medium-sized ctenoid scales; predorsal region covered with smaller, crowded scales to a point half way between dorsal fin and anterior margin of eyes; opercles and cheeks naked; conspicuous papillary ridges of mucous pores on opercles, cheeks, snout, and under side of lower jaw; all fins rather small; dorsal spines 6, dorsal and anal soft rays 9 or 10.

This genus has as its only known representative the species described from Bombay by Day under the name of *Gobius planifrons*.<sup>4</sup> Day's description makes no mention of the barbels on lower jaw, but his figure<sup>5</sup> shows them. This species is represented in the collection of the Siamese Department of Fisheries by 2 specimens 6.5 and 7.5 cm, long from the Menam Chao Phya at Paknam, Central Siam, June 3, 1927, and 3 specimens 6.8, 8.0, and 8.7 cm. long from the Chantabun River at Lem Sing, Southeastern Siam, July 17, 1928. Day's type was about 10 cm. long.

**EUGNATHOGOBIOUS, new genus**

This genus is characterized by an enormous mouth, the maxillary being more than two-thirds the length of head and extending nearly to the preopercle. Associated with this feature are a moderately elongate, compressed body; broad, depressed head; broad snout; small eyes covered with skin; small teeth in several rows in each jaw; emarginate tongue; medium sized, thin ctenoid scales on body; head naked; two well-separated dorsal fins, the first with only 5 rays, the second with 7 branched rays; and anal fin with 6 branched rays.

**EUGNATHOGOBIOUS MICROPS, new species**

*Description*.—Form elongate, dorsal and ventral outlines similar; body strongly compressed posteriorly, the depth 4.5 in standard length and 1.5 in head; head large, broad, and strongly depressed,

<sup>4</sup> Proceedings Zoological Society of London, 1873.

<sup>5</sup> Fishes of India, pl. 63, fig. 9.

its length slightly less than 3 in standard length, its depth 1.7 in its length, and its breadth 1.3 times its depth; snout flat, broad, 4.5 in head; eye small, on dorsal profile, covered with skin, its diameter 2.5 in snout and 2 in the broad, flat interorbital space; mouth very large and oblique, gape wide; lower jaw slightly projecting, maxillary long, and extending to within one eye-diameter of lower angle of preopercle, its length contained 1.4 times in head; tongue broad, emarginate; teeth in 2 or 3 rows in each jaw, outer teeth in lower jaw close-set and larger; least depth of caudal peduncle 0.5 its length and 2.5 in length of head; scales thin, ctenoid, uniform in size, completely covering body, 29 in lateral series, 11 in transverse series under second dorsal, head and base of pectorals naked; opercles, cheeks, and jaws with prominent lines of pores.

Fins: Dorsal rays V-I, 7; first dorsal spine somewhat shorter than second and third, contained 3.5 in length of head and more than 2 in depth of body; second dorsal elevated, separated from first dorsal

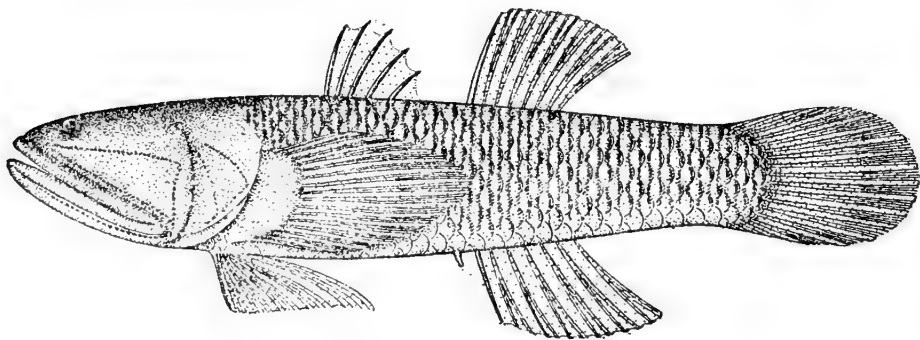


FIGURE 18.—*EUGNATHOGOBIOUS MICRIPS*

by a space nearly equal to snout, its origin slightly in advance of that of anal, the spine 2.5 in length of head; caudal rounded, the central rays equal to depth of body at origin of second dorsal; anal rays I, 6, similar to second dorsal, but the spine somewhat shorter and the soft rays longer; ventrals rather large, extending two-thirds distance to anal; pectorals broad, bluntly pointed, 0.8 length of head, reaching beyond vertical from spine of second dorsal.

Color: Pale brownish-yellow; body with numerous dark brown narrow, vertical lines corresponding with the posterior margin of scales in transverse series; fins plain.

*Type*.—A specimen 33 mm. long over all, 28 mm. to base of caudal, from the lower Bangpakong River, Central Siam, July 1, 1923. Cat. No. 90316, U.S.N.M.

*Remarks*.—This striking species is known from a single specimen obtained from a pongpang net in the swift, tidal part of the Bangpakong River, where small gobies abound in both species and individuals.



**PIPIDONIA, new genus**

Form very elongate; body strongly compressed; head long, depressed, and broad; eyes small, close together; mouth small; teeth small, pluriserial in both jaws; scales cycloid, of moderate size, regularly arranged, head entirely naked; two well-separated dorsal fins, the anterior with five spines.

This genus may readily be distinguished by the greatly elongated body; the broad, depressed head; the widely separated dorsal fins, with only five spines in the first dorsal fin and relatively few rays in the second dorsal and anal fins; the squamation of the body and the naked head; and the fine teeth in bands.

(*Pipidonia*, from Pipidon, the Siamese island where the type was collected.)

**PIPIDONIA QUINQUECINCTA, new species**

*Description*.—Body greatly elongated and markedly compressed, depth 6 in standard length and 1.7 in head; least height of caudal peduncle 2.5 in head; head long, greatly depressed and flattened

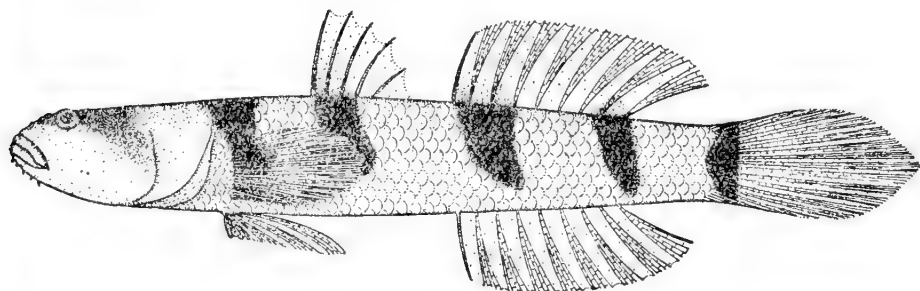


FIGURE 19.—PIPIDONIA QUINQUECINCTA

behind eyes, its greatest width nearly twice its depth and equal to postorbital region, its length 3.5 in standard length; mouth oblique, the maxillary not reaching vertical from anterior border of eye; teeth small, in about 3 rows in each jaw, outer teeth somewhat enlarged; eyes small, on dorsal profile, in anterior third of head, 0.5 length of snout and equal to the flat interorbital space; snout, rami of lower jaw, and median surface of lower jaw with numerous short fleshy filaments; body completely covered with thin cycloid scales of uniform size, 39 in longitudinal series, 10 between origins of second dorsal and anal, 7 before dorsal, and 16 surrounding narrowest part of caudal peduncle; no scales on top of head, opercles, or cheeks.

Fins: Dorsal rays V–I, 8; first dorsal spine 2.25 in head and 1.8 in depth, inserted over 8th scale of lateral series; second dorsal separated from first by space equal to length of snout, the rays of nearly uniform height and equal to longest dorsal spines, the base slightly longer than that of anal and beginning slightly in advance of that fin; caudal broad, wedge-shaped, its length equal to head; anal

similar to second dorsal, the rays I,8; ventrals equal to pectorals and extending more than half distance to anal; pectorals broad, rounded, as long as postorbital part of head.

**Life colors:** Body and head pale yellow; five irregular reddish-brown cross-bands meeting on back and reaching more than half distance to median ventral line, one band on nape extending on base of pectoral, one band under spinous dorsal, two bands under second dorsal, and one band with a straight posterior edge extending entirely across caudal peduncle and base of caudal fin; a dusky area on top of head behind eyes, extending to preopercle; fins hyaline, the three bands under the dorsal fins extending faintly on their bases.

**Type.**—A specimen 2.6 cm. long, taken on Koh Pipidon, west coast of Siam, March 10, 1925. Cat. No. 90317, U.S.N.M.

**Remarks.**—The only known specimen of this fish was obtained in a tide-pool on the small island of Pipidon, on the west coast of Peninsular Siam, south of Puket. It is strikingly marked and is easily recognized notwithstanding its small size.

#### HERREA, new genus

Size minute; body elongate, compressed, scaleless; head blunt, mouth vertical; teeth in each jaw curved, in a single wide-spaced row; anterior teeth in lower jaw elongated; dorsal fins widely separated, the first dorsal with 5 spines, the second dorsal and the anal with 12 branched rays; caudal rounded; ventrals narrow, pointed, not adnate to abdomen.

Resembles *Mirogobius*, described by Herre from the Philippine Islands, in being scaleless and in having a single row of teeth in both jaws, but that genus has postsymphysial canine teeth in lower jaw and only 7 to 9 branched rays in the second dorsal, together with a reduced number of anal rays.

This genus is named for Dr. Albert W. Herre, formerly of the Philippine Bureau of Science, in appreciation of his invaluable monograph Gobies of the Philippines and the China Sea (Manila, 1927).

#### HERREA FORMOSA, new species

**Description.**—Slender, compressed, dorsal profile nearly horizontal; depth contained 6 times in length; head 4.5 in length; snout blunt, 0.5 eye; eye large, more than 3 in head and greater than interorbital space; mouth vertical, a single row of curved, wide-spaced teeth in each jaw, with longer anterior teeth in lower jaw; depth of caudal peduncle 1.5 in its length; no scales on head or body.

**Fins:** Dorsal rays V–I,12; first dorsal separated from second dorsal by a space 1.5 times length of first dorsal base, spines weak, third spine longest; origin of second dorsal somewhat in advance of that of anal, longest rays equal to postorbital part of head, the base 3.5 times that of first dorsal, last ray just reaching caudal; caudal

rounded, short, median rays 1.5 in head; anal similar to second dorsal, the rays I,12; ventrals equal to postorbital part of head; pectorals broad, bluntly pointed, reaching to vertical from last dorsal spine.

Color: Nearly uniform pale olive-yellow; a narrow black median dorsal stripe from tip of snout to base of caudal, extending on caudal and spreading so as to involve upper rays; a broad black lateral band extending from mouth through lower half of eye to base of caudal and thence nearly to posterior margin of caudal fin; the lateral band involves the lower jaw, and on posterior half of body is below the horizontal axis; fins pale yellow.

*Type*.—The only known specimen is 23 mm. long, taken in a rocky tide-pool on Koh Chula (Kite Island), off mouth of Chantabun River, Gulf of Siam, March 17, 1930. Cat No. 90324, U.S.N.M.

CREISSON SEALEI, new species

*Description*.—Body moderately compressed, rather elongate; back not arched but dorsal profile from behind eyes to tip of snout gently decurved; depth 4.5 in standard length, least depth of caudal peduncle 2 in head; head 3.3 in standard length, its width equal to depth; mouth wide, oblique, posterior end of maxillary reaching vertical from anterior edge of eye; tongue truncate; teeth in 4 or 5 irregular rows in anterior part of each jaw, the rows reduced in number at sides, outer row in each jaw enlarged and canine-like, the largest being a backward-curving pair at side of lower jaw, some of the innermost teeth in lower jaw also enlarged; lower jaw slightly the longer, the enlarged teeth projecting in front of upper jaw when mouth is closed; cheeks tumified; anterior nostrils tubular, posterior nostrils large, open, in front of lower half of eye, with a large pore above; eyes latero-superior, inclined upward and outward, 1.5 in snout and less than 1 diameter apart; scales on body large, ctenoid, about 40 in lateral series, 13 in transverse series between origin of second dorsal and anal, 10 around narrowest part of caudal peduncle; scales before dorsal about 34, small, cycloid, extending to a point slightly in advance of posterior border of eyes; a compact patch of small scales on upper border of opercle and cheek, and a few scattered scales on upper half of cheek as far forward as eye; interorbital space and snout naked; base of pectorals and caudal thickly scaled; a large anal papilla.

Fins: Dorsal formula VI-I,10; spines in first dorsal long, slender, the tips of the third to sixth reaching second dorsal when depressed; second dorsal separated from first dorsal by a space equal to diameter of eye, the rays long, the posterior ones longest and reaching base of caudal when depressed; anal rays I,9, similar to second dorsal; caudal broad, rounded, its length greater than head less snout; ventrals broad, as long as postorbital part of head, the frenum

.25 length of fin; pectorals longer than ventrals and extending beyond their tips but not reaching anal papilla.

Color (in alcohol): Back and sides light greenish with vague darker green areas, many scales with pearly bluish spots; under side whitish; head dusky; dorsal, caudal, and anal membranes dusky bluish; ventrals distinctly bluish, with narrow white edge; pectorals dusky.

*Type*.—A specimen 15 cm. long including caudal fin, taken in the Menam Chao Phya at Paknam, Central Siam, May 30, 1930. Cat. No. 90318, U.S.N.M.

*Remarks*.—This species, as yet known from a single specimen, appears to possess all those characters assigned to the genus *Creisson* by Jordan and Seale<sup>6</sup> and by Herre<sup>7</sup> that is, fully squamate body with the anterior scales smaller; scaleless interorbital; small scales on upper part of opercle and cheek; 6 elongate spines in first dorsal and 10 elongate soft rays in second dorsal; teeth in a number of rows in each jaw, with the anterior row enlarged and one or two lateral backward-curving canines in lower jaw.

The only species of this genus heretofore known, *G. validus* Jordan and Seale, inhabits the Philippines. In that species, however, there are 29 to 32 scales in longitudinal series, 10 or 11 scales in transverse series, and about 17 scales before the first dorsal; the body is deeper and the dorsal profile strongly arched; the anal rays are I,7 or I,8; and the coloration is markedly different as regards dorsal and caudal fins, although the general color of body is similar in the two forms.

The species is named for Mr. Alvin Seale, coauthor of the genus, in slight recognition of his valuable contributions to the ichthyology of the eastern Pacific.

**PARAGOBIODON KERRI, new species**

*Description*.—Form comparatively short and deep, the greatest depth of body, at first dorsal spine, 3.25 in standard length; profile strongly convex, snout short, blunt, about equal to eye; head large, deep, and broad, its length greater than its depth and equal to depth of body, its greatest breadth equal to its length; eye 4.5 in head, 1.5 interorbital space; mouth small, oblique (but nearer horizontal than vertical), the maxillary extending to vertical from pupil; a row of short, wide-spaced spines or papillae on preopercle; least depth of caudal peduncle somewhat less than its length and 0.5 head; scales in longitudinal series 22.

Fins: Dorsal fins rather high, the spinous dorsal somewhat lower than the soft dorsal, whose height is about 0.8 greatest depth of body and equal to postorbital part of head; dorsal fins completely separate

<sup>6</sup> Fishes of the Islands of Luzon and Panay, 1907.

<sup>7</sup> Gobies of the Philippines and the China Sea, 1927.

but contiguous, the rays of VI–I,9; soft rays subequal, slender, deeply divided, the last ray reaching caudal when flexed; caudal broad, regularly rounded, the central rays equal to distance from middle of pupil to gill opening; anal rays I,9, similar to but lower than second dorsal, origin of fin under second soft ray of dorsal, base shorter than that of second dorsal, the flexed last ray reaching caudal; pectoral rays 19, the fins broad, rounded, longer than caudal, and reaching somewhat beyond origin of anal; ventrals short, rounded, forming a deep cup, with the rays thickened inside the cup.

Color: Body brownish red, darkest on back; abdomen pale yellow; head pale crimson; all fins except ventrals jet black, the pigment dense and opaque; ventrals black at base, dusky distally; iris green, with golden reflection.

*Type*.—A specimen 1.5 cm. long, taken from a coral head in shallow water at Koh Tao, Gulf of Siam, September 24, 1928. Cat. No. 90319, U.S.N.M.

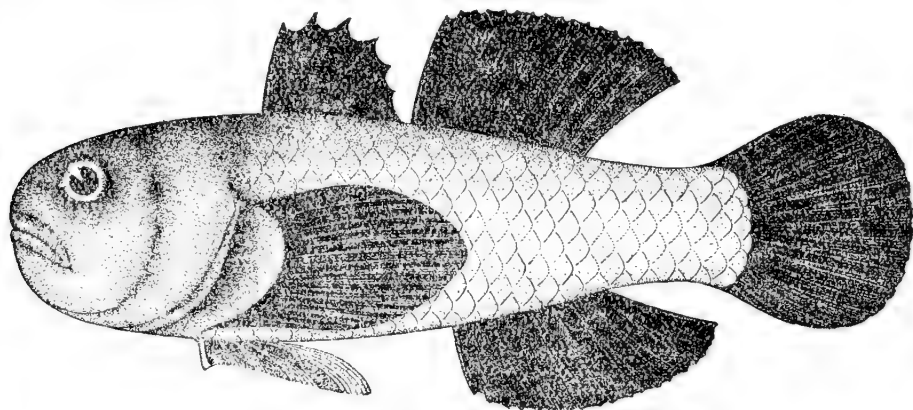


FIGURE 20.—*PARAGOBIODON KERRI*

*Remarks*.—This diminutive goby, of which only a single specimen has yet been collected, is distinguished from closely related species (*melanosomus* and *xanthosomus*) by a combination of characters. Thus, *melanosomus*, known from the east coast of Africa, Dutch East Indies, and Philippines, has 10 soft dorsal rays, 10 soft anal rays, 21 or 22 pectoral rays, and the color black or dark brown with black fins; while *xanthosomus*, from Samoa, Dutch East Indies, and Philippines, has 9 or 10 soft dorsal rays, 8 or 9 soft anal rays, 19 pectoral rays, and the color uniform yellow or green, with all of the fins pale yellow or other clear color, never black.

This little species is named for Dr. A. F. G. Kerr, Government botanist, who has made four visits to Koh Tao and has published the only account of the geography and botany of the island.

**RHINOGOBIUS SIMILIS, new species**

*Description*.—Form moderately elongate, head and body compressed; depth 4.4 in standard length; head not broader than body.

its depth 1.5 breadth, its length 3.5 in standard length; snout obtusely rounded, its dorsal profile rather steep; eyes placed high, entirely above level of mouth, 3.5 in head, slightly less than snout; interorbital space narrow, less than 0.3 eye; mouth oblique, lips rather thick, posterior angle of maxillary reaching vertical from front margin of eye; teeth in both jaws in about 4 rows, the outer row enlarged; on each side of lower jaw posteriorly a pair of large, curved canines which project in front of upper lip; least height of caudal peduncle about 0.5 its length and 0.5 head; branchial aperture restricted, extending anteriorly not more than one-third distance to vertical from posterior margin of eye; body completely covered with large, firm, angular, feebly ctenoid scales, about 28 in lateral line, 9 in transverse line between origin of second dorsal fin and anal; predorsal region as far forward as eyes and side of head above opercle covered with small crowded, irregularly arranged cycloid scales, about 21 in median line; no scales on cheeks or opercles; large cycloid scales on breast and on base of pectorals; a large pore at each end of interorbital space.

Fins: Dorsal VI-I,9; spinous dorsal low, the spines slightly produced, the longest less than depth of body; second dorsal rather low, its base less than length of head, the posterior rays reaching caudal when depressed; caudal broad, rounded, rather short, less than head; anal similar to second dorsal, its ray I,9; ventrals broad, rounded, extending nearly or quite to vent; pectorals as long as head less snout and reaching slightly beyond ventrals.

Color (in life): Body and head light brown; middle of side with 4 rather diffuse dark brown spots, the first under the spinous dorsal, the last at base of caudal fin; 4 similar dorsal spots alternating with the others; a round blackish spot about size of eye at upper end of gill opening; first dorsal fin rich brown, the color most intensive on either side of fifth and sixth rays, the fourth, fifth, and sixth membranes clear distally, and entire base of fin clear; second dorsal elaborately decorated with brown and plumbeous in transverse lines, a narrow brown border, a series of elongate plumbeous spots with a narrow colorless line above and below, a broad median band of mottled brown and plumbeous, and a basal band of plumbeous spots separated from the median band by a clear line; caudal rays brown, the membranes mostly clear; anal dusky, without definite pattern; ventrals brown, with central part slightly plumbeous; pectorals pale brown.

*Type*.—A specimen 7.7 cm. long taken in Bandon Bight, Gulf of Siam, September 21, 1923. Cat. No. 90320, U.S.N.M.

A second specimen 6.6 cm. long, taken at the same time and place as the type, is in the collection.

*Remarks.*—The specific name given to this fish is in allusion to its strong resemblance to *Rhinogobius caninus* (Cuvier and Valenciennes), known from China, Philippines, and East Indies. The principal points of dissimilarity are the more decurved snout, larger eye, nonprojecting lower jaw, absence of scales on upper part of opercle, and coloration of body and fins.

**RHINOGOBIUS ATRIPINNATUS, new species**

*Description.*—Body elongate, rather plump, moderately compressed; superior profile rising in a regular, gentle curve from snout to dorsal fin; depth under first dorsal equal to head less snout and contained 4 times in standard length; head small, 3.3 in length, its width greater than depth at eyes; eye rather small, a little less than 5 in length of head, equal to snout and greater than interorbital space; mouth oblique, rather small, lower jaw slightly projecting, posterior angle of jaws under anterior part of eye; teeth in 3 or 4 rows in each jaw, those in outer row enlarged and wide-spaced; a large, stout, backward-curved lateral canine on each side of lower jaw; tongue truncate at tip; least height of caudal peduncle 1.5 times in its length and 2 times in head; scales large, weakly ctenoid, 27 in longitudinal series, 9 in transverse series; predorsal scales small, extending into interorbital space, about 25 in median line; large scales on the somewhat fleshy base of pectorals; cheeks and lower half of opercles naked, upper half of opercles with large scales; prominent lines of mucous pores on the head, including a double row extending horizontally entirely across middle of cheek, 3 rows on lower part of cheek, a suborbital row continuous with a postorbital row extending along upper margin of opercle to upper angle of gill opening.

Fins: Dorsal rays VI–I, 10; anal rays I, 10; spinous dorsal rather low; soft dorsal similar to anal, neither when depressed reaching caudal; ventrals rather short, extending about two-thirds distance to anal; pectorals longer than ventrals and equal to head less snout.

Color: Body and head light brown, without markings; muzzle blackish; all fins black except pectorals which are dusky.

*Type.*—A specimen 6 cm. long, taken in the Gulf of Siam off the Tachin River, Central Siam, December 14, 1927. The fish is a female with well-developed ovaries. Cat. No. 90321, U.S.N.M.

*Remarks.*—In this species the extent of the squamation of the opercles resembles *Vaimosa*, but the presence of large lateral canine teeth in the lower jaw indicates *Rhinogobius*, a genus which, as Herre<sup>8</sup> has pointed out, is “a catch-all for a heterogeneous assemblance not conveniently placed elsewhere.”

In addition to the type, the collection of the Siamese Department of Fisheries contains a specimen 6 cm. long taken in the Menam

<sup>8</sup> Gobies of the Philippines and the China Sea.

Chao Phya at Paknam, Central Siam, August 16, 1924, and a specimen 8.5 cm. long from the Chantabun River at Lem Sing, South-eastern Siam, July 17, 1928.

**CRYPTOCENTRUS LEONIS, new species**

*Description.*—Body elongate, moderately compressed, the greatest depth (at origin of first dorsal fin) contained 6 times in standard length; head large, rather deeper and broader than body, its length 3.3 in standard length, depth and breadth equal; profile between eyes and dorsal fin straight and nearly horizontal, anterior profile very steep, almost vertical; snout blunt, its length somewhat more than diameter of eye; mouth large terminal, slightly oblique, lips thick and papillose; gape extending to a point under posterior part of eye and maxillary reaching half an eye-diameter beyond a vertical from posterior margin of orbit; teeth in a band in each jaw, the outer row enlarged but not canine; anterior nostril in a long tube;

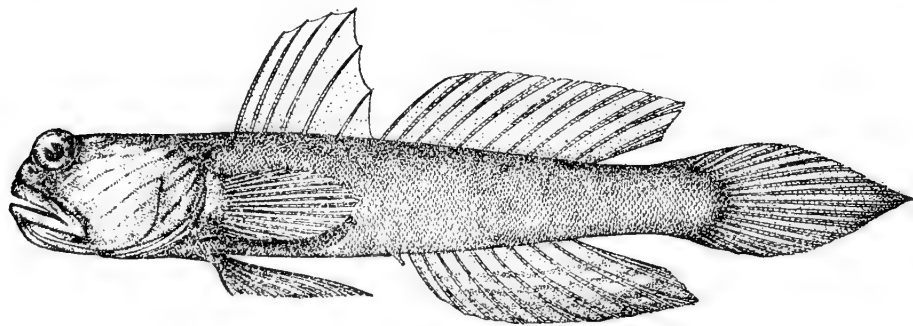


FIGURE 21.—CRYPTOCENTRUS LEONIS

chin rounded and prominent, cheeks tumid; eyes prominent, situated at the junction of the superior and anterior profiles, very close together, diameter of eye 0.5 length of head; interorbital space narrow, less than 0.5 eye; depth of caudal peduncle 0.5 its length and contained 3 times in head; scales cycloid, minute, somewhat larger posteriorly, about 125 in longitudinal series from upper angle of branchial aperture, about 30 in transverse series between origins of second dorsal and anal; pectoral base naked; breast covered with small, embedded scales; predorsal region scaled to a point half way between gill opening and eyes, the scales small, about 35 in median line; opercles and cheeks unscaled.

Fins: Dorsal rays VI–I, 10; anal rays I, 9; first dorsal rather high, anterior spines longer than depth of body, the tips slightly produced; second dorsal similar to anal but its base longer; posterior rays of both second dorsal and anal the longer and reaching caudal when depressed; caudal large, broad, pointed, its length exceeding head; ventrals rather broad, rounded, not reaching vent, their length somewhat more than postorbital part of head; pectorals shorter than ventrals, their base fleshy.



**Color:** Entire body a uniform reddish-brown without any markings; head a somewhat lighter and richer brown, with cheeks and opercles traversed by about 8 narrow, oblique, widely separated dark brown stripes extending downward and forward, these stripes margined by a lighter brown than on the interspaces; a few dark brown spots on upper lip and top of head; fins plain light brown, with following exceptions: the anal shows a dark brown margin and three dark brown stripes parallel with the free border; the ventral membranes are finely barred with blackish-brown; and the pectorals in life have a row of indistinct dark brown rounded spots across the base of the rays.

**Type.**—A specimen 13.5 cm. long over all, 10.5 cm. to base of caudal, taken in the estuary of the Chantabun River at Lem Sing (Lion Point), Southeastern Siam, July 17, 1928. Cat. No. 90322, U.S.N.M.

**Remarks.**—This species is known from a single example. It may be readily distinguished by its peculiar physiognomy, which strongly suggests a *Periophthalmus*, with its prominent eyes situated far forward on the upper profile of the large head.

**APOCRYPTODON MALCOLMI, new species**

**Description.**—Body very elongate, cylindrical anteriorly, compressed posteriorly, the depth contained 6.4 times in standard length; head broad and somewhat flattened above, the breadth slightly more than depth, the length contained rather more than 4 times in length of body; snout broadly rounded, its length 4 times in head; eyes on top of head but directed more laterally than dorsally, 1.5 times in snout 6 times in head; interorbital space about 0.5 eye; mouth large, nearly horizontal, lower jaw included, maxillary almost 0.5 length of head and reaching 1 eye-diameter behind vertical from posterior border of eye; width of mouth equal to length of gape; teeth in upper jaw widely spaced, club-shaped, inclined outward, the 3 median teeth on each side enlarged, curved, and fang-like; teeth in lower jaw horizontal, bifid, and 14 or 15 on each side, increasing gradually in size from symphysis outward, the outermost under middle of eye; post-symphyseal canines small; caudal peduncle short, its least depth greater than its length and 2.8 times in head; scales in longitudinal series 60, in transverse series (between second dorsal and anal) 13, predorsal scales 26, body scales larger posteriorly, nape and side of head as far forward as eyes completely covered with small scales, the squamation being defined by an oblique line extending from posterior margin of eye to antero-inferior point of opercle.

**Fins:** Dorsal rays VI–I, 22, the two fins close together and connected by a low membrane; dorsal spines with elongate tips, their length increasing gradually to fourth whose length exceeds depth of body

and equals length of head without snout, fifth and sixth spines shortest; second dorsal rather low, the rays of nearly equal length, 0.5 head, last ray shortest, its base separated from caudal by a space less than 0.5 depth of peduncle: the pointed caudal somewhat longer than head; anal I, 21, similar to second dorsal, its origin posterior to second soft ray of dorsal: ventrals somewhat longer than the bluntly-pointed pectorals and extending half way to anal papilla.

Color: Light brown above, bluish-white on abdomen and under side of head; head and body with numerous small round black spots of irregular distribution, a few spots extending on base of soft dorsal fin: a series of 6 diffuse round dark brown blotches extending along middle of side from head to caudal, and 5 vertically elongate similar blotches extending downward from median line of back, alternating with the round blotches, several obscure blotches on top

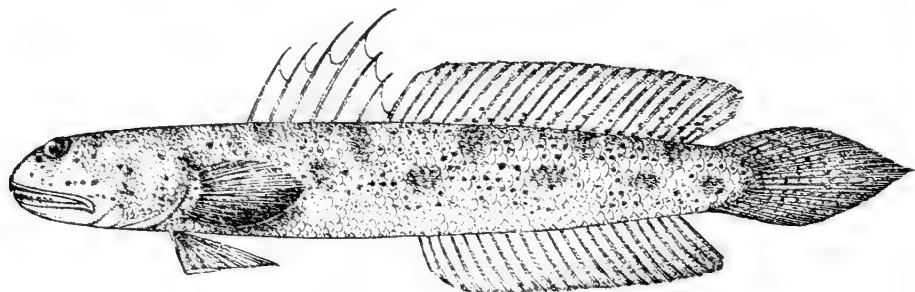


FIGURE 22.—*APOCRYPTODON MALCOLMI*

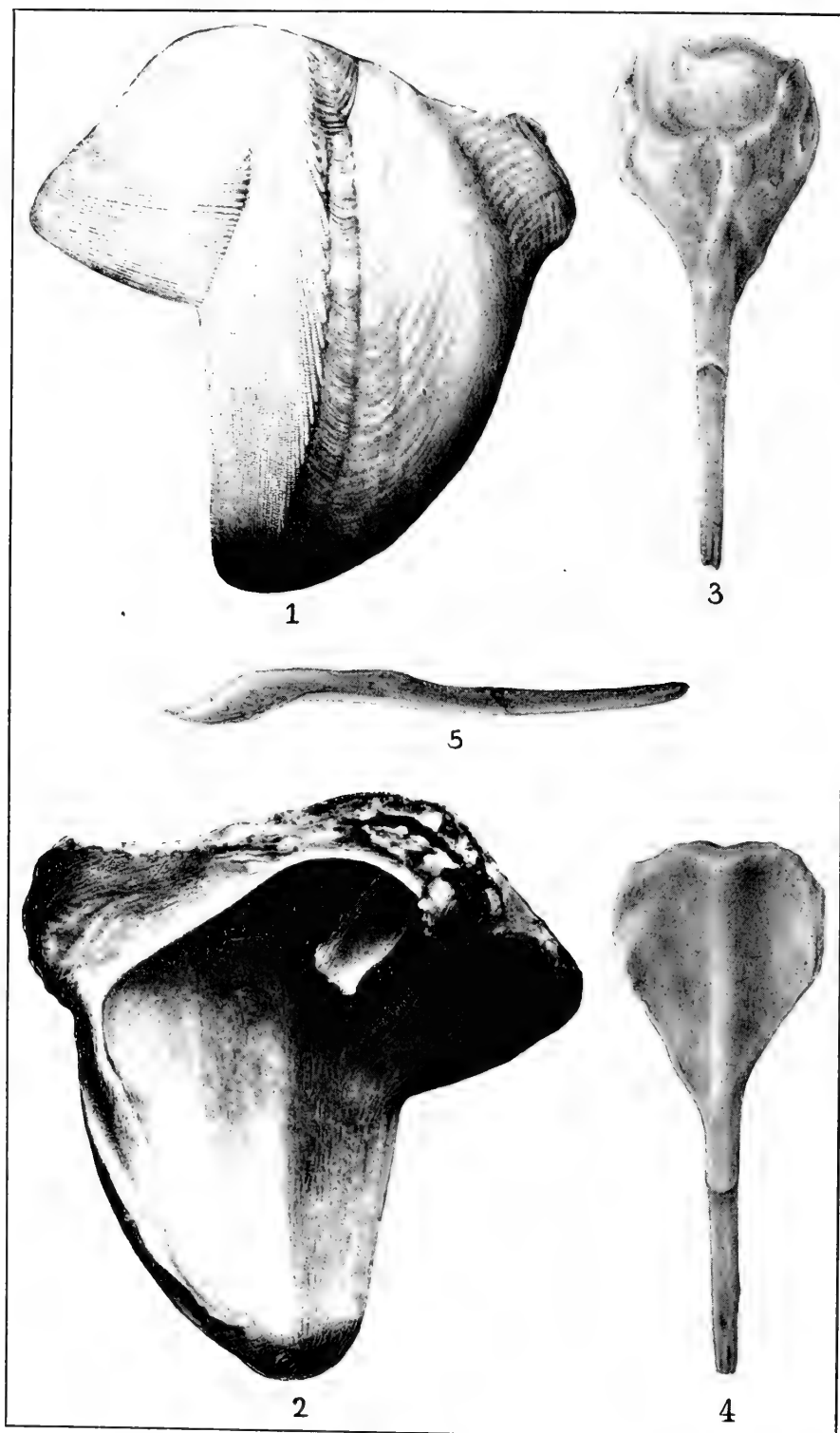
of head: first dorsal unmarked: caudal dusky, with faint cross-lines of brown spots; and with dusky edge; pectorals with blackish lower half.

*Type*.—This species is as yet known from a single specimen, 7.5 cm. long, taken June 14, 1928, at the mouth of the Chantabun River, Southeastern Siam. It is a female with well-developed ovaries. Cat. No. 90323, U.S.N.M.

*Remarks*.—Of the half dozen species of *Apocryptodon* known from India, Malay Archipelago, and Philippines, this species appears to be mostly closely related to *A. bleekeri* (Day). That form, however, according to Day's description and figure, has a different shaped head, longer maxillary (extending to preopercle), cheeks densely scaled as far forward as anterior margin of eye, and different coloration.

Named for Dr. Malcolm A. Smith, F. Z. S., for many years resident in Siam, in appreciation of his interest in, and important contributions to the knowledge of, the zoology of Siam.





A NEW SHIPWORM FROM VENEZUELA

FOR EXPLANATION OF PLATE SEE PAGE 3.

## A NEW SHIPWORM FROM VENEZUELA

By PAUL BARTSCH

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A sending of shipworms collected in Maracaibo Bay, Venezuela, includes an undescribed species belonging to the subgenus *Neoteredo*. This now gives us three species in that subgenus, namely, *Teredo* (*Neoteredo*) *reynei* Bartsch from British Guiana and Surinam; *Teredo* (*Neoteredo*) *miraflora* Bartsch from the Canal Zone, Panama, and the present species, *Teredo* (*Neoteredo*) *healdi* from Venezuela.

When I published my monograph of the American shipworms, Bulletin No. 122, United States National Museum, I did not have the pallets of *Teredo* (*Neoteredo*) *miraflora*. These have since come to hand. I am, therefore, now able to give comparative data of both shell and pallet characters.

The dental ridges on the anterior part are finer and more closely spaced in *Teredo* (*Neoteredo*) *reynei* and *Teredo* (*Neoteredo*) *miraflora* than in the new species. In the types of the three species the following number of dental ridges remain: *Teredo* (*Neoteredo*) *reynei*, 125; *Teredo* (*Neoteredo*) *miraflora*, 97; *Teredo* (*Neoteredo*) *healdi*, 56. The anterior median area bearing the dental ridges is almost twice as wide in *Teredo* (*Neoteredo*) *reynei* as it is in *Teredo* (*Neoteredo*) *healdi*, while in *Teredo* (*Neoteredo*) *miraflora* it is intermediate between the two. The number of dental ridges in the types of the three species across the anterior median area parallel with the ventral border of the anterior area are: *Teredo* (*Neoteredo*) *reynei* 83; *Teredo* (*Neoteredo*) *miraflora*, 46; *Teredo* (*Neoteredo*) *healdi*, 38. The pallets of the three species also offer diagnostic characters. In *Teredo* (*Neoteredo*) *reynei* the blade is quite small; it measures: Length, 7.2 mm.; diameter, 2.5 mm. In *Teredo* (*Neoteredo*) *miraflora* it measures: Length, 7.1 mm.; diameter, 3.1 mm. In *Teredo* (*Neoteredo*) *healdi* it has a length of 7.5 mm. and a diameter of 3.3 mm. The outside of the blade is also less deeply cut in *Teredo* (*Neoteredo*) *healdi* than in *Teredo* (*Neoteredo*) *miraflora*, which it most resembles. The sulcus below the cup is also less defined in the present species.

## TEREDO (NEOTEREDO) HEALDI, new species

Plate 1, figs. 1-5

Shell large, subglobose, yellowish white, excepting the central portion of the median area which is a little darker; the interior is bluish white. The extreme anterior edge forms a moderately deep sinus bordered by a moderately thick callus. From the inner edge of this callus the dental ridges spread in a fan-shaped manner. The earlier of these dental ridges have been eroded, but 56 of them remain, of which the later are much more closely spaced than the early ones. The earlier ridges are separated by spaces about three times as wide as the ridges at their posterior extremity, while in the last portion of the space that separates the dental ridges is less than the width of the ridges at their posterior extremity. These ridges are finely denticulated at the free border. The sides of these dental ridges slope much more abruptly dorsally than ventrally. The anterior median portion is moderately broad and is marked by closely approximated denticulated ridges, of which 38 are present in a line parallel with the ventral border of the anterior part. These ridges join those of the anterior part at a considerably larger angle than a right angle. The cusps on these dental ridges are large and single cusped and not denticulated. The central median portion is somewhat depressed, its anterior border being strongly marked off from the posterior, anterior portion; its anterior half being marked by rough, irregularly curved transverse lines. The posterior median portion is about as wide as the anterior and middle median portion combined, and is marked by rough lines of growth which curve more abruptly anteriorly than on the posterior part where they assume a decidedly dorsal slant. The posterior part forms only a moderately strong auricle, which is slightly concave and is marked by inconspicuous wrinkled lines of growth. It should be said here that the dorsal portion of the shell in adult specimens, including the auricle, is badly eroded. The suture joining the anterior and median portion is not conspicuous on the inside. The central median portion is marked by a shallow roughened groove, bearing a conspicuous knob at its ventral termination. The anterior portion of the posterior part projects over the median part as a strong shelf. The blade, projecting from the umbone, is irregular in shape and extends obliquely a little more than half-way across the inside of the shell, having its origin immediately beneath the quite prominent umbonal knob. The pallets are spoon shaped, cupped at the distal extremity with a stalk one and one-half times the length of the blade. The stalk shows as a rib on the inside of the blade.

The type, Cat. No. 381921, U. S. N. M., was taken from a piling by Mr. K. C. Heald, at Cabimas about 20 miles southeast of Mara-

caibo, Venezuela, on the east side of the lake. It measures: Height, 10.7 mm.; length, 10.2 mm.; thickness, 12.0 mm. The pallets measure: Length, 7.5 mm.; diameter, 3.3 mm.

In addition to the type other specimens were collected by Mr. Heald in Maracaibo Harbor and at Lagunillas about 40 miles southeast of Maracaibo on the east side of the lake. These are also in the collection of the United States National Museum.

#### EXPLANATION OF PLATE

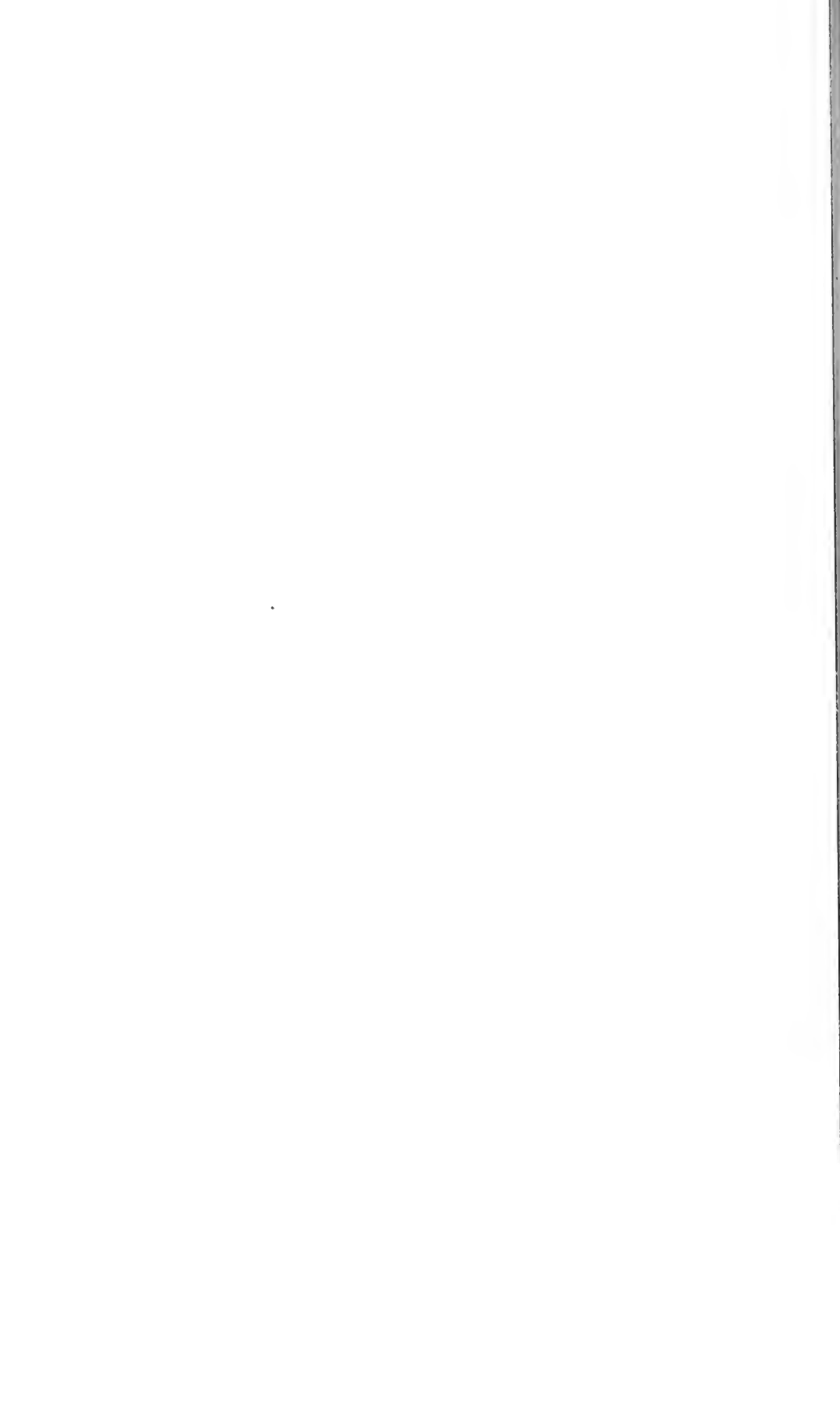
Figure 1. Exterior view of type.

2. Interior view of type.

3. Exterior view of pallet.

4. Interior view of pallet.

5. Lateral view of pallet.





# A NEW SPECIES OF TROÖDONT DINOSAUR FROM THE LANCE FORMATION OF WYOMING

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By CHARLES W. GILMORE

*Curator of Vertebrate Paleontology, United States National Museum*

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## INTRODUCTION

The intensive search to which the Lance formation of Niobrara County, Wyo., has been subjected by fossil-hunting expeditions should seemingly have exhausted that field so far as new dinosaurian reptiles are concerned, especially the larger forms. It appears, however, that the possibilities of a field are never fully exhausted, as is attested by the recent discovery of an incomplete skull which rivals *Ankylosaurus* in size and has the massive bony, domelike enlargement of the skull, which is one of the striking characteristics of the genus *Troödon*. The large size of the specimen as well as certain differences in skull structure at once distinguishes it from the described species of this genus, all of which are from the geologically more ancient Judith River and Belly River formations. The discovery of more perfect material in the Lance may disclose characters that will necessitate the founding of a new genus, but for the present I shall refer the specimen to the genus *Troödon*, and propose the name *wyomingensis* to designate the species.

The occurrence of *Troödon* in the Lance fauna was reported by the late J. B. Hatcher<sup>1</sup> in 1905. In the article cited, under the heading *Troödon validus*, he says: "Teeth of a very similar size and pattern are not uncommon in the Laramie [Lance] of Converse [now Niobrara] County, Wyo." The discovery of the present specimen is therefore in a way corroborative of Hatcher's observations of 25 years ago.

## Family TROÖDONTIDAE, 1924

### Genus TROÖDON, 1856

#### TROÖDON WYOMINGENSIS, new species

Plates 1, 2, and 3

*Type*.—U.S.N.M. No. 12031; consists of the upper posterior half of the skull, including the occipital region downward nearly to the foramen magnum.

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<sup>1</sup> Hatcher, J. B., U. S. Geol. Survey Bull. 257, p. 82, 1905.

Collected by George F. Sternberg, August 25, 1930.

*Type locality*.—About 9 miles SW. of Warren P. O., Buck Creek, Niobrara County, Wyo.

*Horizon*.—Lance formation, Upper Cretaceous.

The specimen includes most of the upper half of the back portion of the skull. The occipital border and the lateral border of the left side forward of the infratemporal fenestra are preserved, thus furnishing the full posterior width of the skull. Anteriorly the skull is abruptly broken off back of the median prolongation of the frontals. The median part of the massive dome was broken down prior to discovery and much of its upper surface is missing, but enough of the surrounding area remains to give a fairly accurate conception of the full shape and extent. For the purpose of illustration the missing part of the dome has been carefully modeled, following the contours of the original adjacent surfaces, with the result shown in Plate 1, Figure 1.

The cranium-shaped enlargement is the outstanding feature of the *Troödon* skull, the elevation having the form of a subovate boss (pl. 2, fig. 2), that reaches its maximum height posterior to the line of the orbits. At the center above the brain the estimated thickness is not less than 180 mm. The central swelling is broadly convex transversely but more moderately so in a longitudinal direction. That this specimen is of a fully adult individual is indicated by the coalescence of all sutures, few of which can now be distinguished.

The dome surface is perfectly smooth and lacks the foramina and markings so characteristic of the *T. validus* skulls. Fractured surfaces show the internal bone to be very dense as contrasted with the more or less porous structure of the Belly River *Troödonts*. The differences pointed out may, however, be only an age characteristic.

Viewed from above, the outline of the skull ends rather squarely behind. At the base of the domelike enlargement, a broad shelf, strongly overhanging the occiput, extends backward. The upper surface of this shelf is only slightly less steeply inclined than the surface of the dome itself. Thus, in profile it is quite unlike *T. validus*, in which the shelf forms nearly a right angle with the dome mass. (Compare figs. 1 and 2, pl. 1.) The median part of the parietal surface is devoid of ornamentation, as is the whole heavy, rounded occipital border, in striking contrast to the ornate surface of the *T. validus* skull. On either side of the smooth area, in the position of the supratemporal fossae, is a large cluster of rounded protuberances. Since parts of the skull are missing from both sides, complete detailed information of this ornamentation is not available. These rounded nodes have the appearance of each being on the basal end of separate angularly cone-shaped ossifications that together completely fill the supratemporal fossa. In fact, it is clearly

indicated that the boundary of this opening on the posterior side is formed by an outwardly directed process of the parietal joining an inwardly directed process of the squamosal, as is usual in other dinosaurian skulls.

The bone structure of these dermal ossifications appears distinctive of the Troödont dinosaurs, and on that account is worthy of detailed description. Each of the sections from the supratemporal area that are surmounted by a rounded node fractures downward taperingly to more or less of a point. The bone fibers of these broken surfaces concentrate at a focal point at this lower end, which no doubt explains the reason for the similarity of the fractures. A somewhat similar radiating structure was noted on the broken surfaces of the dome mass before the pieces were cemented together. This fact leads to the suggestion that the dome, after all, may not be a thickening of the parietal and frontal bones, as formerly thought, but is a concentration of a series of dermal ossifications that have become fused, not only to one another but to the underlying skull elements. Further evidence favoring such an interpretation is found in Troödont skulls studied by Lambe,<sup>2</sup> in which he notes that the structure of the bone forming the dome is columnar in section.

On the left side of the specimen the squamosal and much of the postfrontal are present, but they are so fully coalesced, not only with one another but with the adjacent skull elements, that their extent and limitations can no longer be determined. The squamosal is exceedingly massive and apparently forms the whole of the posterior external angle of the skull. Its upper external surface is sparsely covered with low, rounded tubercles of varying size, but below and in front of these the bone surface is lumpy but otherwise smooth. The upper surface of the postfrontal forms a narrow shelf along the lateral base of the dome. Whether the squamosal also contributes to the formation of this shelf can not be determined. The outer edge is rounded, not raised as in *T. validus*. On the under side the squamosal is cupped for the reception of the quadrate head, which is missing in this specimen. Back of this cotylus a heavy, slightly curved, bluntly pointed process represents the posterior overhang of the squamosal. All of the skull elements, including a forward portion of the postfrontal bone, are missing. The smooth but pitted areas that form the roof of the orbital cavities are preserved on the ventral side (pl. 3, fig. 2), and these accurately indicate the position of the orbits.

When the top of the orbital roof and the upper boundary of the infratemporal fossa coincide on a horizontal line the upper part of

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<sup>2</sup> Trans. Roy. Soc. Canada, ser. 3, vol. 12, p. 24, 1918.

the occiput occupies a nearly horizontal plane. The occipital region from a point somewhat above the position of the foramen magnum is in a good state of preservation. At the center a flattened triangular area that narrows ventrally represents the supraoccipital bone. Unfortunately, as in other parts of the skull, the sutures are all obliterated. The smoothness of this central area is quite unlike the deeply concave surface of the *T. validus*<sup>3</sup> skull, which has a low sharp vertical ridge at the center.

On either side lateral to this flattened central area are the wing-like expanded processes of the paraoccipitals, which are directed strongly outward and backward, their outer ends passing smoothly into the posterior branch of the squamosals.

## MEASUREMENTS

	Mm.
Greatest width of skull across squamosals.....	310
Distance from center of orbital roof to rear of skull.....	244
Greatest width of dome mass.....	275
Greatest thickness about.....	180

*Troödon wyomingensis* may be at once distinguished from the known species of the genus by its much larger size. Judging by the few skull measurements obtainable, the type specimen is more than twice the size of the largest *T. validus* cranium known from the Belly River formation. It is further distinguished by the complete closure, by dermal bones, of the supratemporal fossae, the smooth unsculptured surface of the dome, and the simpler ornamentation of the cranium throughout. From *T. validus* Lambe it differs further in having a flattened supraoccipital area without a median ridge, and a more steeply inclined parietal region posterior to the dome, the latter making quite a difference in profile when viewed from the side, as is clearly shown by comparing Figures 1 and 2, Plate 1.

## NOTES ON REFERRED SPECIMEN

In Plate 4, Figures 1 and 2, are illustrated two incomplete bones, U.S.N.M. No. 7806, that were collected from the Lance formation of Niobrara County, Wyo., by J. B. Hatcher in 1890. It has long been suspected that these fragmentary parts pertained to some undescribed member of the Lance fauna, and on that account they have been shown to practically all visiting paleontologists. Up to this time no one would hazard a guess as to their origin. It was quite generally agreed that they were dermal ossifications, one of which was ornamental in character. With the acquisition of the skull of *Troödon wyomingensis* their origin seems to be explained.

<sup>3</sup> Gilmore, Charles W., Bull. No. 1, University of Alberta Press, p. 21, 1924.

The ossification illustrated in Plate 4, Figure 1, is quite certainly an ornamental dermal bone having a compressed upper extremity whose edge is serrated with toothed denticles. That it was in contact with another of perhaps similar shape is indicated by a sutural surface at one end. The broken basal portion shows that the striation of the bone radiates from a focal point near the lowermost pointed end. Precisely the same type of structure is to be observed in the bone filling the supratemporal opening of the *T. wyomingensis* skull, and for that reason I am of the opinion that this fragment represents a dermal ornament of a *Troödon* skull. If these deductions are correct it shows the presence of a type of ornamentation unknown in the earlier *Troödonts*.

The second fragmentary piece, Plate 4, Figure 2, shows a similar radiating structure, but as yet I am unable to hazard a guess as to what part of the animal it may represent. The bone is especially dense and heavy and the external side is peculiarly roughened.

A fragment (pl. 5, fig. 1), U.S.N.M. No. 8795, included in a small lot of miscellaneous dinosaur armor plates collected by Charles H. Sternberg, in Niobrara County, Wyo., is quite certainly a portion of the squamosal of a *Troödont* dinosaur. This is indicated not only by the thick, rounded protuberances of the dorsal surface but also by the deep suture at one end, a feature that is peculiarly characteristic of the cranial elements of the *Troödont* skull.

These fragmentary parts, briefly described, give evidence of at least two individuals beside the type, and no doubt others will now be recognized among the miscellaneous bones from this formation in other collections.

#### NOTE ON *TROÖDON FORMOSUS* LEIDY

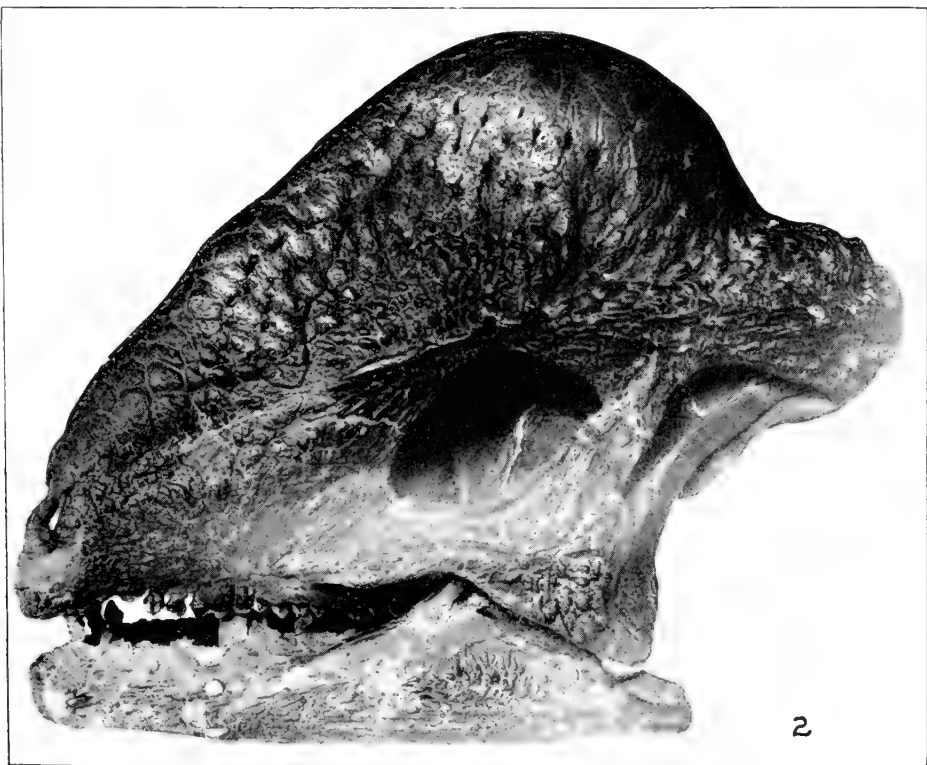
The above genus and species were established by Leidy,<sup>4</sup> on the crown of a single tooth from the Judith River formation of Montana. In the years that have elapsed since this first discovery a few other detached teeth have been found in this same formation. These constitute the only known materials referable to the present species. Recently in looking over some fragmentary dinosaurian specimens in the paleontological collections of the National Museum, I came across a fragmentary portion of a skull that was at once recognized as pertaining to the genus *Troödon*. (See pl. 5, fig. 2.) This specimen was collected by J. B. Hatcher, July 7, 1888, from the Judith River beds on Cow Island, Mont., a place not far removed from the type locality. It would therefore seem fair to infer that it belongs to the species *T. formosus* Leidy. If this assignment is correct it furnishes the first information on this species other than from teeth.

<sup>4</sup> Proc. Acad. Nat. Sci. Philadelphia, vol. 8, p. 72, 1856.

The specimen consists principally, if not entirely, of the frontal bones, which display the characteristic thickening that forms a dome above the brain. In size it agrees very closely with the partial skull described by Lambe<sup>5</sup> as *T. validus* from the Belly River of Alberta. In size, thickness of dome, surface sculpturing, and in the ventral view showing the contribution to the walls of the orbit and brain case, the two specimens, so far as they can be compared, appear to be identical. A question is thus raised as to the distinctness of the two species. The materials in hand are not yet sufficient for a positive determination of this point, but in the light of this fragmentary specimen, the possibility of their being one and the same thing is indicated. In that event, *T. validus* would become a synonym of *T. formosus*, which has priority by many years.

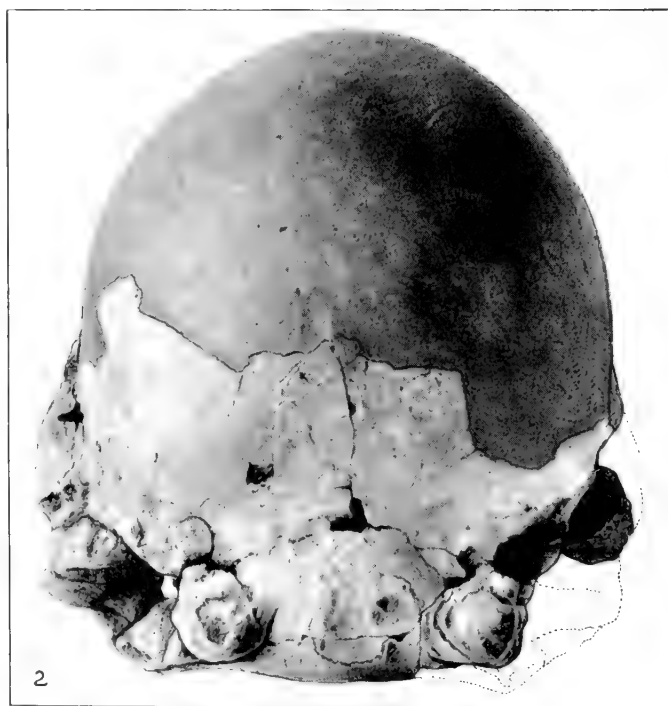
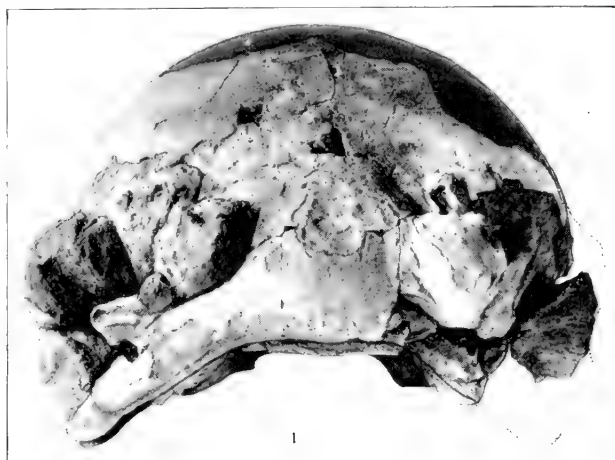
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<sup>5</sup> Trans. Roy. Soc. Canada, ser. 3, vol. 12, pl. 1, fig. 1, 1918.



## TROÖDON SKULLS

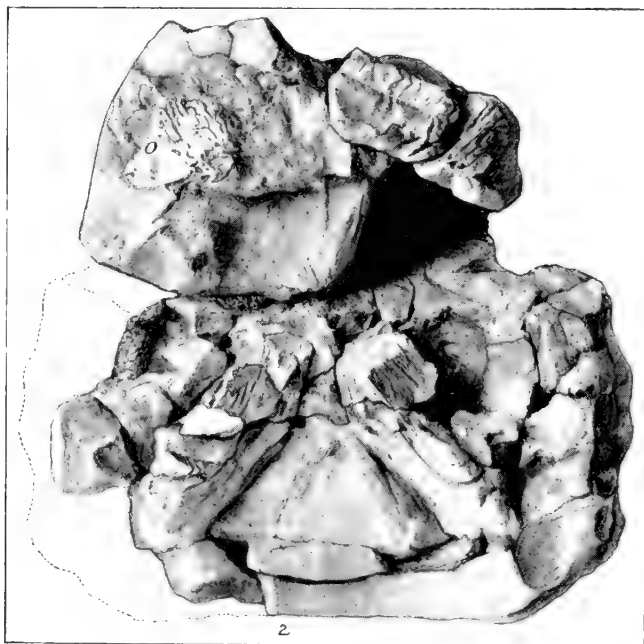
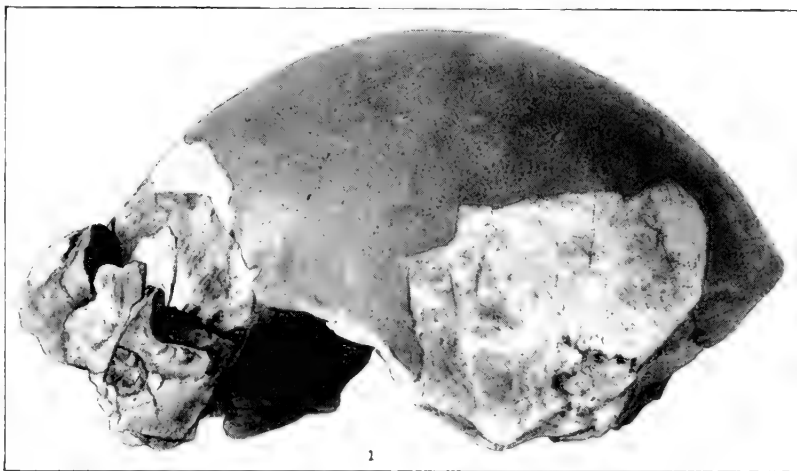
1, Skull of *Troödon wyomingensis*. Type, U.S.N.M. No. 12031. Viewed from left side. About one-fourth natural size; 2, skull of *Troödon validus* Lambe, viewed from the left side. Specimen in the University of Alberta Museum, Edmonton, Canada. About one-half natural size.



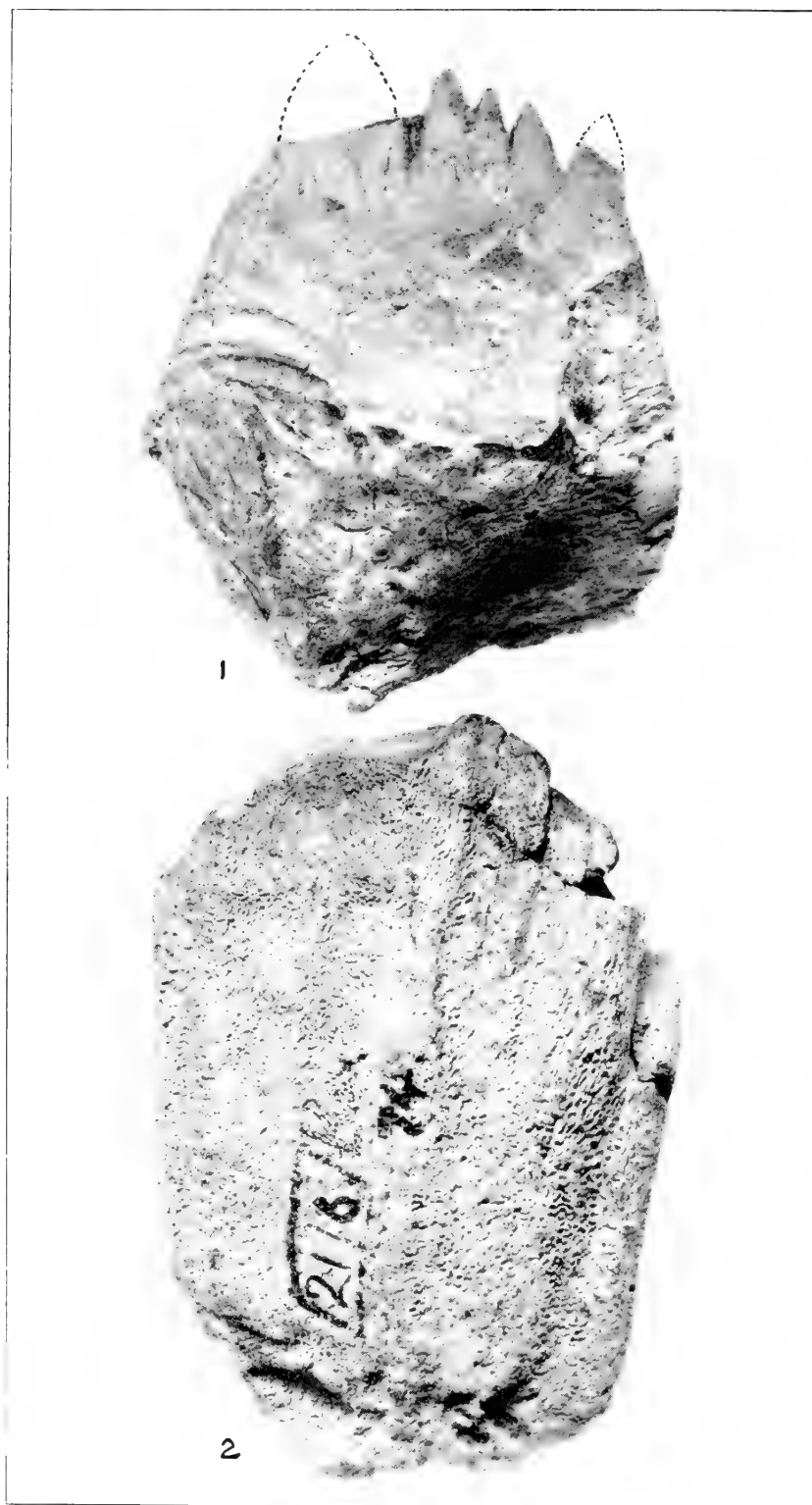
SKULL OF TROÖDON WYOMINGENSIS

1, Type, U.S.N.M. No. 12031. Viewed from the rear; 2, the same, viewed from above. Both figures about one-fourth natural size.



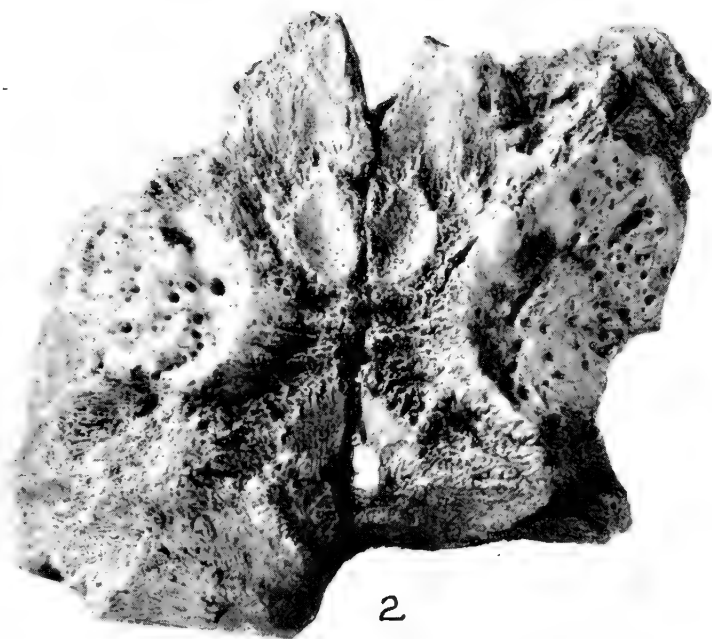
SKULL OF *TRICODON WYOMINGENSIS*

1, Type, U.S.N.M. No. 12031. Viewed from the right side; 2, the same, viewed from below. *O*, Roof of orbital cavities. Both figures about one-fourth natural size.



## TROÖDON BONES

1, Dermal skull bone of *Troödon* sp. U.S.N.M. No. 7806; 2, unidentified bone of *Troödon* sp. U.S.N.M. No. 7806. Both figures about natural size.



TROÖDON BONES

- 1, Skull bone of *Troödon* sp. U.S.N.M. No. 8795; 2, frontal bone of *Troödon formosus* Leidy. U.S.N.M. No. 11934. Ventral view. Both figures about natural size.



# REPORT ON BIRDS RECORDED BY THE PINCHOT EXPEDITION OF 1929 TO THE CARIBBEAN AND PACIFIC

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and

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The Pinchot South Seas expedition of 1929, organized by the Hon. Gifford Pinchot, had as part of its objective the making of scientific collections and the recording of the natural history of the regions visited. The party left New York Harbor on the yacht *Mary Pinchot* on March 31, 1929, traveled south to Key West, and through the Caribbean Sea to Panama. The journey was continued through the Panama Canal to various islands in the Pacific and on October 15 was terminated in Tahiti. Through press of time the party returned by steamer to San Francisco.

Through the cooperation of the United States Biological Survey and the interest of Mr. Pinchot, the senior author accompanied the party as one of the naturalists, devoting his attention largely to birds but also studying and collecting in other groups. The collections of birds secured include approximately 500 skins and skeletons, with a few eggs, collected and prepared with the assistance of Mr. Pinchot and Gifford Pinchot, jr. Through the kindness of Mr. Pinchot and the courtesy of the Biological Survey the material has been deposited in the United States National Museum, where it forms a most welcome accession, since in addition to one form new to science it includes 22 others not previously represented in the national collections.

In the following report the senior author has supplied field notes and observations, including some on species of birds of which skins were not collected, while the junior author has identified the specimens, and made such critical comments as seem pertinent. The avifauna of the Caribbean islands and that of the Pacific islands are so essentially different that for convenience the report that follows is presented in two sections, the Isthmus of Panama serving as the dividing line between the two geographic regions considered.

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## THE BIRDS OBTAINED ON THE CARIBBEAN ISLANDS

The *Mary Pinchot*, while en route between Key West and Cristobal, Canal Zone, made anchorages at four islands in the Caribbean Sea, affording opportunity to secure natural-history specimens. With a long journey to the objective in the Pacific area in contemplation, stops en route were necessarily brief but yielded valuable results, although necessarily only partial collections were made. The actual time available was further reduced by the necessity for seeking out favorable localities for birds in territory entirely new to the collector.

Those in authority on all of the islands were kind and considerate and did all they could to tender assistance. Collecting was done on the west end of the island of Grand Cayman from North Cove to Borden on April 16 and April 17. It was regretted that time did not permit a visit to the eastern part of the island, which has greater elevation, more extensive forests, and less population. It is reached from the westward by poorly defined trails, and is difficult to approach from the sea, except under very favorable wind conditions. So far as possible, ground showing varied physical conditions was visited, ranging from the edge of mangrove swamps through rough brush to drier and more open plantations.

The party arrived at Swan Island (pls. 1 and 2) the morning of April 19, and spent the greater part of the day and the day following there and on Little Swan Island (pl. 1). The latter is a coral upheaval quite different from the larger island, from which it is separated by a narrow passage. It is probably 60 feet high and very much torn, which makes travel difficult, especially as the crevices are overgrown with cactus and other resistant plants. Travel on the larger island was comparatively easy, since it is level and largely covered by coconut groves and grassy areas. The clumps of thick shrubbery usually were not large enough to cause much trouble. It was interesting to see familiar migrating warblers in rollicking, scattered groups making short, erratic flights from bush to tree, gleaning luckless insects on their way, much as they do later in the year in the northern woods.

The island of Old Providence (pl. 2), of volcanic origin, with high peaks and long ridges, is very different from and much more picturesque than the low-lying islands previously visited. Collecting was done mainly along trails back from the sea and in canyons, which in the rainy period carry good-sized streams, but at this



Photograph by H. H. Cleaves

SWAN ISLAND, CARIBBEAN SEA



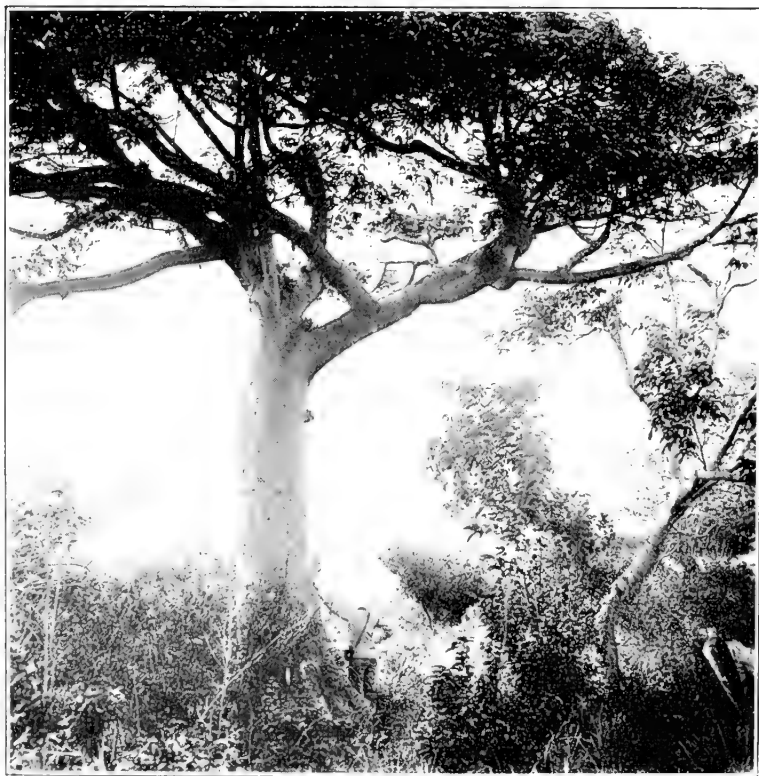
Photograph by A. K. Fisher

TYPICAL SCRUB ON LITTLE SWAN ISLAND



Photograph by A. K. Fisher

COCONUT GROVE, SWAN ISLAND



Photograph by H. B. Cleaves

OLD PROVIDENCE ISLAND, CARIBBEAN SEA



season contained only pools in the deeper depressions. The ship was at Old Providence three days, but birds were collected mainly on April 23 and 24.

St. Andrews, another coral uplift, was visited on April 27; during the few hours devoted to collecting only 10 species of birds were seen, and 6 of these were obtained.

**SULA LEUCOGASTRA LEUCOGASTRA (Boddaert)**

Brown booby

*Pelecanus leucogaster* BODDAERT, Tabl. Planch. Enl., 1783, p. 57. (Cayenne.)

Often seen on the wing away from land. A good-sized colony of breeding birds was found on Little Swan Island, April 20, with young of different stages of development.

**SULA PISCATOR (Linnaeus)**

Red-footed booby

*Pelecanus piscator* LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 134. (Java Seas.)

A common breeding bird on Little Swan Island, where young of different stages of growth were observed on April 19 and 20. Seen at various times in flight over the sea.

**FREGATA MAGNIFICENS Mathews**

Frigate bird, man-o'-war bird

*Fregata minor magnificens* MATHEWS, Austr. Av. Rec., vol. 2, December 19, 1914, p. 120. (Barrington Island, Galapagos Archipelago.)

There was a large breeding colony on Little Swan Island, April 19 and 20, where the birds were seen in flight on various occasions.

**ARDEA HERODIAS Linnaeus**

Great blue heron

*Ardea herodias* LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 143. (Hudson Bay.)

One was seen at the narrow rift between Little Swan and Big Swan Islands.

**FLORIDA CAERULEA CAERULESCENS (Latham)**

Little blue heron

*Ardea caerulescens* LATHAM, Index Orn., vol. 2, 1790, p. 690. (Cayenne.)

At Grand Cayman a native woman killed one with a stick, but when secured the bird was not in condition for a specimen. At St. Andrews Island one in white phase of plumage was seen near an island pond which was nearly dry.

**BUTORIDES VIRESCENS VIRESCENS (Linnaeus)**

Little green heron

*Ardea virescens* LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 144. (Coast of South Carolina.)

A female taken on Swan Island April 19, 1929, is an example of the green heron of North America, present here as a migrant. This bird lacks the lighter edgings of the scapular feathers found in most specimens of this race, but this is also true of numerous skins from eastern North America; otherwise it is similar in color to them. It measures as follows: Wing, 174.0; tail, 61.3; culmen, 61.0; tarsus, 49.3 mm.

The identification of this bird brings up for consideration the status of the supposed resident form of Swan Island currently known as *Butorides virescens saturatus* Ridgway,<sup>1</sup> represented by two skins in the United States National Museum collected by Dr. Charles H. Townsend on Swan Island, March 6 and 26, 1887. These two skins are very dark, being in fact remarkably suggestive in general appearance of *Butorides v. frazari* of Lower California. They have the following dimensions: Wing, 177.0–178.0; tail, 59.9–62.7; culmen, 61.0–61.2; and tarsus, 51.6–50.4 mm.

Dr. Thomas Barbour writes that in his visits to Swan Island he has not found the green heron nesting, and that George Nelson, of the Museum of Comparative Zoölogy, who has been on the island five times with an average stay of two months each time, likewise failed to find these birds breeding. Further, it appears that there is no suitable habitat for them, the few herons of this group that appear being migrants which have been seen flying in from the coast of Honduras and these do not remain on the island long. The two Townsend specimens have the dimensions of the *B. v. virescens*, and, although much darker than normal, are matched by occasional birds from the eastern United States (notably by U. S. N. M. No. 77293, from Hernando County, Fla.). The two collected by Doctor Townsend are here identified as *Butorides virescens virescens*, so that the name *B. v. saturatus* Ridgway will be listed in the synonymy of this race.

The bird secured, the only one observed on the island, alighted at the landing place before the launch, and was shot almost immediately. Naturalists seldom have the good fortune to obtain so easily material that is destined to straighten out moot questions based on faulty specimens. Since for long periods there is no fresh water on the island except that collected in closed cisterns, it would seem very improbable that green herons would attempt to breed there.

<sup>1</sup> *Butorides saturatus* Ridgway, Proc. U. S. Nat. Mus., vol. 10, August 6, 1888, p. 577. (Swan Island, Caribbean Sea.)

**BUTORIDES VIRESCENS MACULATUS (Boddaert)**

West Indian green heron

*Cancroma maculata* BODDAERT, Tabl. Planch. Enl., 1783, p. 54. (Martinique, Lesser Antilles.)

A female from Grand Cayman taken April 16, 1929, has the following measurements: Wing, 166.0; tail, 58.4; culmen, 57.4; and tarsus, 43.2 mm. It has the small size and light coloration characteristic of this race of the little green heron which is found throughout the Greater Antilles.

This individual, which was taken at the edge of the mangroves at North Cove, was very similar in voice and action to the northern subspecies. It was the only one observed.

**FALCO COLUMBARIUS COLUMBARIUS Linnaeus**

Pigeon hawk

*Falco columbarius* LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 90. (Carolina.)

One of these little falcons was seen at close range as it flew above an opening at the west end of Swan Island.

**GALLINULA CHLOROPUS (Linnaeus)**

Florida gallinule

*Fulica chloropus* LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 152. (England.)

On Grand Cayman Island, April 16, 1929, while in pursuit of the green heron, the collectors drove a gallinule out of the thick mangroves and would have taken it if it had not been considered more important to secure the heron. This was the only one seen among the islands visited.

If it is assumed that this bird was a migrant, as would seem of necessity to be the case, it should be the North American subspecies *G. c. cachinnans*.

**COLUMBA LEUCOCEPHALA Linnaeus**

White-crowned pigeon

*Columba leucocephala* LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 164, (Bahama Islands.)

An adult male was taken on Grand Cayman April 16, 1929, by A. K. Fisher, and another on Swan Island, April 19, by Gifford Pinchot.

This pigeon was common on both Grand Cayman and Swan Islands. A sharp lookout was kept for other species, so that any movement among pigeons was noticed. For this reason many more white-crowned pigeons were seen than would have been the case if

one species only occurred on the island. This is a fine bird and might rival the band-tailed species of the western United States as a game bird.

ZENAIIDA ZENAIIDA ZENAIIDA (Bonaparte)

Zenaida dove

*Columba zenaida* BONAPARTE, Journ. Acad. Nat. Sci. Philadelphia, vol. 5, June, 1825, p. 30. (Florida Keys.)

A female, taken on Grand Cayman, April 17, 1929, by G. B. Pinchot, is like specimens from elsewhere in the range of this race. It has the following measurements: Wing, 149.4; tail, 86.1; culmen with cere, 13.4; tarsus, 22.5 mm.

In this connection it is of interest to consider the status of *Zenaida spadicea* Cory,<sup>2</sup> which was recognized by Ridgway<sup>3</sup> after examination of the original material, but which has not been found by subsequent collectors. Bangs<sup>4</sup> in 1911 received 13 specimens of the Zenaida dove from Grand Cayman, Little Cayman, and Cayman Brac taken in May, June, and July, 1911, by W. W. Brown, jr., and says that there is no difference between birds from the three islands in question. All are *Zenaida z. zenaida*, and are similar to that race as found throughout its extensive range. Bangs therefore cites *Zenaida spadicea* Cory as a synonym of *Zenaida zenaida zenaida* (Bonaparte), in which he seems to be entirely correct.

Through the courtesy of Dr. C. E. Hellmayr the type and three other specimens of *Z. spadicea* in the collection of the Field Museum of Natural History have been available for examination. The type is a male taken on Grand Cayman, August 23, 1886, by W. B. Richardson. The other three are marked as males and were secured on the same island on August 18 and 23. They have the dimensions of *Zenaida z. zenaida*, but are very deeply rufescent in color, being much darker than any true Zenaida doves seen, which is apparently due in part to grease soaking out on the feathers; in part, as Bangs has already suggested, to wear, which has removed the bloom from the plumage; and in part possibly to something used as a preservative when the skins were prepared. The junior author considers them stained, abnormal skins of *Zenaida zenaida zenaida*. This is supported by the fact that Cory, in the Auk for 1886, page 502, in listing the birds taken on Grand Cayman Island by W. B. Richardson during the expedition in question gives *Zenaida spadicea* as the

<sup>2</sup> *Zenaida spadicea* Cory, Auk, 1886, p. 498. (Grand Cayman.)

<sup>3</sup> U. S. Nat. Mus. Bull. 50, pt. 7, 1916, p. 362.

<sup>4</sup> Bull. Mus. Comp. Zool., vol. 60, March, 1916, pp. 306-307.

only Zenaida dove, whereas subsequent collectors have found the true Zenaida dove, but have taken nothing that could be recognized as *spadicea*.

The specimen taken in 1929, the only one seen, was obtained at the point visited which was farthest from the more settled areas. If time had permitted collecting in the wilder parts of the island to the eastward, it is very probable that more would have been found, since reports show that birds live in more abundance there.

MELOPELIA ASIATICA ASIATICA (Linnaeus)

White-winged dove

*Columba asiatica* LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 163. ("Indiis"=Jamaica.)

Two skins taken on Old Providence Island, Colombia, April 25, 1929, are in molt on the head and forepart of the body. One is an adult male, the other an immature individual with sex not marked. The adult is renewing the wing feathers. These two seem to have the white on the throat somewhat more extensive than in birds from elsewhere, but this difference is not altogether certain, and from this material the Old Providence bird is identified as typical *asiatica*. The male has the following measurements: Wing, 156.5; tail, 100.9; culmen with cere, 18.9; tarsus, 24.4 mm. The early date of molt seems remarkable.

This pigeon was very common on the island and its cooing was heard everywhere. It furnished good sport for the captain and members of the crew. Other species, although carefully looked for, were not observed.

COLUMBIGALLINA PASSERINA INSULARIS Ridgway

Cuban ground-dove

*Columbigallina passerina insularis* RIDGWAY, Proc. U. S. Nat. Mus., vol. 10, August 6, 1888, p. 574. (Grand Cayman.)

Three specimens taken on Grand Cayman April 17, 1929, by Gifford Pinchot and A. K. Fisher, include two males and a female. These specimens have the following measurements:

Males: Wing, 81.4-85.0; tail, 57.8-61.3; culmen with cere, 10.7-10.9; tarsus, 15.5-15.8 mm.

Female: Wing, 81.0; tail, 57.0; culmen with cere, 9.8; tarsus, 15.9 mm.

This little dove was common in all the open places visited. In its actions it was identical with the form occurring in Florida, feeding or quarreling most of the time.

## AMAZONA LEUCOCEPHALA CAYMANENSIS (Cory)

## Cayman parrot

*Chrysotis caymanensis* CORY, Auk, 1886, p. 497. (Grand Cayman Island, West Indies.)

Two males and one other specimen with sex not marked were taken by Gifford Pinchot and A. K. Fisher on Grand Cayman April 17, 1929. On comparison with a considerable series from Cuba the alleged color differences are not apparent, the only evident distinction being that of slightly greater size.

The males have the following measurements: Wing, 195.0–201.0; tail, 119.0–119.9; culmen from cere, 26.3–25.9; tarsus, 22.5–23.9 mm. As these measurements are within the maximum for typical *A. l. leucocephala*, the supposed characters of *caymanensis* would seem to be very slight.

This form is new to the collections of the National Museum.

Quite a number of parrots were seen, but on only a few occasions was it practicable to collect them. They were rather silent except when individuals of a flock became separated from one another; then in true parrot fashion they voiced their troubles. We were told that when certain fruits were ripening the parrots visited the door-yards where such food was found, to enjoy the unwilling hospitality of the owner. Those which we saw feeding appeared to eat the ovaries and internal soft parts of flowers.

## COCYZUS MINOR MAYNARDI Ridgway

## Bahama mangrove cuckoo

*Coccyzus maynardi* RIDGWAY, Man. North Amer. Birds, Sept., 1887, p. 274. (Ten Thousand Islands, Fla.)

A female in excellent plumage taken on Grand Cayman April 17, 1929, represents the present form, agreeing in its pale coloration with a series of *maynardi* from the Bahamas, and differing decidedly from the darker forms *nesiotes* of Jamaica and *teres* of Hispaniola and Porto Rico, and farther south and east. It has the following measurements: Wing, 126.3; tail, 162.0; culmen from base, 27.0; tarsus, 27.4 mm.

The subspecies of the mangrove cuckoo from Grand Cayman has been an undecided question. The specimens examined by Ridgway<sup>5</sup> from this island were in such worn condition of plumage that he was uncertain whether they were *nesiotes* or *maynardi*, but finally called them the former. Bangs<sup>6</sup> identified a series taken by W. W. Brown, jr., from May to July, 1911, on the three islands of the Cayman group as *nesiotes*, remarking: "These specimens agree with Jamaican skins

<sup>5</sup> U. S. Nat. Mus. Bull. 50, pt. 7, 1916, pp. 25, 27.

<sup>6</sup> Bull. Mus. Comp. Zool., vol. 60, 1916, pp. 309, 310.

in size and proportions and are a little larger than the Bahaman form *C. m. maynardi* Ridg. In the color of the under parts this series shows a wide range of individual variation. The darkest ones are exactly like the paler specimens from Jamaica and the palest ones like the darker examples of *maynardi*. Thus as a whole the series averages a little paler below than the average of a long series of *nesiotes* from Jamaica. All, however, were taken later in the season than any skin we have from Jamaica and are without doubt somewhat faded out."

As the specimen secured by Doctor Fisher is in fresh plumage there is no question as to its identity with *maynardi*.

Whenever we were in the vicinity of mangrove swamps we kept a sharp lookout for cuckoos, since added specimens from this island were needed to work out properly the distribution of the insular forms. Failing to find them in this habitat it was an agreeable surprise to run across an individual in the thick, low undergrowth of an abandoned or much-neglected banana plantation in a dry upland stretch of country. As the bird was in dense foliage near the ground, it was not recognized until it had moved toward the outer edge of the clump it was occupying. It was tame and unsuspecting and did not seem to notice the approach of a stranger.

The yellow-billed and black-billed cuckoos of the north frequently utter thin "rain-crow" notes, and are heard very much more often than they are seen. If this holds true for the mangrove cuckoo, it must be uncommon in the localities visited, as its notes were not once heard, and the individual secured was the only one seen by members of the party.

#### COCYZUS MINOR ABBOTTI Stone

##### Abbott's cuckoo

*Coccyzus abbotti* STONE, Proc. Acad. Nat. Sci. Philadelphia, vol. 51, 1899, p. 301. (St. Andrews Island, Caribbean Sea.)

An adult male was taken on Old Providence Island April 24, 1929. This bird has the following measurements: Wing, 135.8; tail, 165.5; culmen from base, 30.5; tarsus, 27.4 mm. It is in full, perfect plumage. Superficially this specimen has the general appearance of *C. m. nesiotes* and *C. m. teres*, being deep buff below like the average of those races. Above it is grayer on the head and hind-neck than *teres*, and is also characterized by larger, heavier bill.

This race has not been represented previously in the National Museum collections.

Although cuckoos were frequently heard and glimpses were caught of two or three others as they flew from thick shrubbery, the one mentioned above was the only one secured. It is true that while

Captain Beale was dove hunting he shot a cuckoo, but it was picked and beheaded by a willing native before the captain learned what had happened. The notes of this bird were similar to those of the other cuckoos.

**CROTOPHAGA ANI Linnaeus**

Ani

*Crotophaga ani* LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 105. (Jamaica.)

Two were taken on Grand Cayman, April 16 and 17, 1929.

This interesting species, locally known as "jew bird," was found in pastures, woods, and in fact anywhere from the roadside to the deepest forests. It is in good standing with the majority of people where ticks are common, on account of its fondness for these troublesome pests.

**CHORDEILES MINOR VICINUS Riley**

Bahaman nighthawk

*Chordeiles virginianus vicinus* RILEY, Auk, 1903, p. 432. (Long Island, Bahamas.)

A male taken on Swan Island April 19, 1929, is apparently the first record of the nighthawk for this locality. This specimen measures as follows: Wing, 169.0; tail, 99.1; culmen from base, 6.0; tarsus, 15.3 mm. Though more buffy than some, it agrees in paler coloration with many of the Bahama Island race, and is lighter than *C. m. gundlachii* of Cuba, which geographically is the race that might be expected for a Swan Island bird. It is probably a migrant, as the Bahama form comes to those islands only to breed and goes south again at the approach of winter.

A few nighthawks were seen flying over Grand Cayman the afternoon of April 17 but none was taken.

**ANTHRACOTHORAX PREVOSTII HENDERSONI (Cory)**

Old Providence hummingbird

*Lampornis hendersoni* CORY, Auk, 1887 p. 177. (Old Providence Island, Caribbean Sea.)

Two immature birds were taken on Old Providence Island on April 23 and 24, 1929, one a male and the other not having the sex determined. These are decidedly duller green, less bronzy above, than any skin of *A. p. prevostii* in similar stage seen, in addition to having a smaller bill. One has the bill damaged and is otherwise injured by shooting. The other, a male, has the following dimensions: Wing, 67.0; tail, 35.3; culmen from base, 21.6 mm. This race is new to the national collections.

Hummingbirds were quite common, but did not often come near enough to be collected with a small charge. The damaged specimen



was taken with a large load, when it alighted too far away for a smaller one.

These hummers seem to share an irritable disposition with other members of the family. One of them entering another's domain or approaching a preempted flower is attacked and rushed in no uncertain manner. It is probable that there is some change, and that conditions are less tense, when there is an abundance of flowers, and food is secured with little effort.

ANTHRACOTHORAX NIGRICOLLIS PINCHOTI Wetmore

Pinchot's hummingbird

*Anthracothorax violicauda pinchoti* WETMORE, Proc. Biol. Soc. Washington, vol. 43, 1930, p. 7. (St. Andrews Island, Caribbean Sea.)

Use of the specific name *violicauda* in the original description of this race was in accordance with Mathews' statement in the Austral Avian Record, vol. 3, 1915, p. 42, where the figure given by Daubenton in the Planch. Enl., 671, Figure 2, is identified as *violicauda* of Boddaert (1783), which on this basis replaced *nigricollis* of Vieillot (1817). Doctor Hellmayr considers Mathews' treatment erroneous, and, after examination of the plate, and some study of the question, the junior author agrees with Hellmayr that Daubenton's figure refers to the female of the hummer currently known as *Anthracothorax viridigula* (formerly *A. gramineus*), so that the name *nigricollis* is the proper one for the species of hummer here under discussion. The bird from St. Andrews Island therefore will be known as *Anthracothorax nigricollis pinchoti*. Daubenton's figure agrees with *viridigula* in showing the throat stripe green, and seems more nearly to represent that species.

The type of this new race, a male, the only specimen secured, was collected on St. Andrews Island April 27, 1929. These hummingbirds have long been known on St. Andrews, but their allocation to the typical form of *Anthracothorax nigricollis* of the distant mainland of South America has seemed anomalous, so it has not been surprising to find that the single specimen obtained by the Pinchot expedition differs on careful comparison with a long series of true *nigricollis* from the eastern portions of northern South America. A second specimen from St. Andrews, an adult male with a broken bill, collected May 1, 1887, by Dr. W. L. Abbott, has been available for examination through loan from the Academy of Natural Sciences. From these two birds it appears that the male of the St. Andrews bird is generally similar to true *Anthracothorax n. nigricollis* (Vieillot)<sup>7</sup> but has the black of the throat and breast restricted, and bordered by metallic green instead of blue on the sides of the

<sup>7</sup> *Trochilus nigricollis* Vieillot, Nouv. Dict. Hist. Nat., vol. 7, 1817, p. 349. (Brazil.)

throat and upper foreneck. Following are measurements of the two specimens at hand: Two males, wing, 65.9<sup>s</sup>–69.5 (67.7); tail, 36.1<sup>s</sup>–37.8 (37.0); culmen, 24.8<sup>s</sup> mm.

The type skin, which is not quite adult, differs from the specimen secured by Abbott, which is older, principally in being greener above and in having the black of the breast somewhat more obscured by greenish. *A. n. pinchoti* seems to have carried to an extreme the differences that distinguish *A. n. iridescens* of western Ecuador.

The new form was named in honor of Gifford Pinchot.

During the morning of April 27, two hummers were seen in an area beyond the outlying habitations. Unfortunately, on account of the scarcity of flowers the flight of these birds was erratic and continued for long distances between individual flowers, so that it was not possible to collect them. It was very disappointing not to have an opportunity to secure specimens, but as the time for leaving was near, the collecting field had to be left behind. While the senior author was standing with a native policeman on the main street of the town, awaiting the arrival of the launch from the yacht, a hummer suddenly flew by and alighted on a dead twig of a neighboring tree. As quick as thought the bird came tumbling out of the tree. The quickness and accuracy of the shot seemed to have impressed the policeman, and he evidently forgot any embarrassing regulation that may have been broken in the interest of science.

MEGACERYLE ALCYON ALCYON (Linnaeus)

Belted kingfisher

*Alcedo alcyon* LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 115. (In America.)

A kingfisher was heard, and later seen, at Swan Island.

COLAPTES CHRYSOCAULOSUS GUNDLACHI Cory

Grand Cayman flicker

*Colaptes gundlachi* CORY, Auk, 1886, p. 498. (Grand Cayman, West Indies.)

A male taken on Grand Cayman Island April 17, 1929, has the following measurements: Wing, 129.9; tail, 102.1; culmen from base, 32.3; tarsus, 25.5 mm.

This race is new to the collections of the National Museum.

A number of these flickers were seen and heard among the large trees of the localities visited and had it been known at the moment that material was very desirable more would have been collected. The note of this species is similar to that of the golden-winged flicker, and the specimen taken was lured by imitating the rapidly repeated *whit to whit* to love call of the northern bird.

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<sup>s</sup> Type specimen.

**CENTURUS CAYMANENSIS** Cory

Grand Cayman woodpecker

*Centurus caymanensis* CORY, Auk, 1886, p. 499. (Grand Cayman, West Indies.)

Two males and a female were taken on Grand Cayman, April 17, 1929, by A. K. Fisher and G. B. Pinchot. All are adult.

In action and habit this species reminds one of the red-bellied woodpeckers of the United States.

**TOLMARCHUS CAUDIFASCIATUS CAYMANENSIS** (Nicoll)

Grand Cayman patchary

*Pitangus caymanensis* NICOLL, Ibis, 1904, p. 582. (Grand Cayman, West Indies.)

Four males and one female were taken on Grand Cayman, April 17, 1929, by A. K. Fisher and G. B. Pinchot. The junior author agrees with Hellmayr<sup>9</sup> that this insular form should be recognized as a race of *Tolmarchus caudifasciatus caudifasciatus* of Cuba.

The present series adds a new race to the collections of the National Museum.

Until one becomes acquainted with this species it can be mistaken very easily for the gray kingbird. It is found more often in the woods than in the open country, which is the favorite feeding ground of the related species. In its movements it more nearly resembles the crested flycatchers (*Myiarchus*) than the other related forms. It was a common bird that was general in suitable localities over the areas visited.

**MYIARCHUS SAGRAE SAGRAE** (Gundlach)

La Sagra's flycatcher

*Muscicapa Sagrae* GUNDLACH, Boston Journ. Nat. Hist., vol. 6, 1852, p. 313. (Cuba.)

A male and another specimen with sex not marked were taken on Grand Cayman, April 16, 1929, by A. K. Fisher and G. B. Pinchot. These two are in slightly worn plumage and appear grayer above and blacker on the head than a series from Cuba. However, there is a female specimen in the National Museum taken on Grand Cayman, March 15, 1887, that is identical with birds from Cuba.

These two specimens, which were taken in the woods near the edge of a mangrove swamp, were the only ones seen. Their movements were characteristic of the genus.

<sup>9</sup> Cat. Birds Amer., pt. 5, 1927, p. 157.

**MYIOCHANES VIRENS (Linnaeus)**

Wood pewee

*Muscicapa virens* LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 327. (Carolina.)

A female was taken on Swan Island, April 19, 1929. This migrant species seems to occur here with regularity, as a number of them were seen.

**ELAENIA MARTINICA CAYMANENSIS Berlepsch**

Cayman elaenia

*Elaenia martinica caymanensis* BERLEPSCH, Proc. Fourth Int. Orn. Congr., 1907, p. 394. (Grand Cayman, West Indies.)

A fine series of seven males, four females, and one other with sex not marked was taken on Grand Cayman Island April 16 and 17, 1929, by A. K. Fisher and G. B. Pinchot. These birds are in excellent plumage and are quite uniform in color, the only difference being that some are slightly more yellowish than others.

This flycatcher was one of the common forms and one that responded readily to the calls of the collector used to attract birds. It fed extensively on certain berries, and in manner of feeding resembled somewhat the waxwings, especially in filling up to capacity. When for any reason it became excited it elevated its crest so that the white crown was plainly visible.

**ELAENIA MARTINICA CINERASCENS Ridgway**

Old Providence elaenia

*Elainea cinerascens* RIDGWAY, Proc. U. S. Nat. Mus., vol. 7, 1884, p. 180. (Old Providence Island, Caribbean Sea.)

A female in somewhat worn plumage was collected on Old Providence Island, April 23, 1929.

A common species on Old Providence. Elaenias were seen also on St. Andrews, but on account of limited time no specimens were collected.

**HIRUNDO ERYTHROGASTER Boddaert**

Barn swallow

*Hirundo erythrogaster* BODDAERT, Tabl. Planch. Enl., 1783, p. 45. (Cayenne.)

On April 18, as the ship was passing from Grand Cayman to Swan Island, a barn swallow came aboard. It was rather tired and there was no difficulty in catching it so that Mr. Cleaves might make a moving picture of it. The species was observed on Swan Island, and considerable numbers were seen on April 24 and April 27 on both Old Providence and St. Andrews, catching insects over broad, moist areas. On May 8 at Cristobal, Canal Zone, not far from where the yacht was docked, several hundred of this species, with a small

number of bank swallows, made an interesting sight. Evidently many insects were swarming from the ground. At a distance the mass of them suggested a sand whirl or smoke column broadening out from a restricted base. The swallows began their attack on this flight not more than a yard above the surface, rising in widening circles to 20 feet or more above, when they would swing downward to resume operations once again at the base of the funnel.

**MIMUS POLYGLOTTOS ORPHEUS (Linnaeus)**

Jamaican mocking bird

*Turdus orpheus* LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 169. (Jamaica.)

Two males, one female, and one with sex not marked were taken on Grand Cayman Island, April 16, 1929, by A. K. Fisher and G. B. Pinchot. All are adults in somewhat worn plumage.

The mocking bird was common everywhere, both in town and in the outlying districts. Oftentimes when a number were together there was sure to be misunderstanding among them and a running fight would ensue. Whether this irritability was due to trespass on one another's domain, appropriation of one another's food, or to sexual jealousy was not evident.

**MIMUS MAGNIROSTRIS Cory**

Large-billed mocking bird

*Mimus magnirostris* CORY, Auk, 1887, p. 178.<sup>10</sup> (St. Andrews Island, Caribbean Sea.)

A female of this striking bird was secured on St. Andrews Island, Caribbean Sea, April 27, 1929. It is in somewhat worn plumage.

This mocker was the only one seen, and the song was not heard in the areas which were visited.

**DUMETELLA CAROLINENSIS (Linnaeus)**

Catbird

*Muscicapa carolinensis* LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 328. (Virginia or Carolina.)

A female catbird was taken on Grand Cayman Island April 17, 1929.

This familiar species was more or less common on both Grand Cayman and Swan Islands, but was not seen on either Old Providence or St. Andrews. It was among the first to be attracted from the shrubbery by a chirping noise, and, as in the north, readily approached, uttering its rather discordant notes.

<sup>10</sup> Though this appears in the number for July, an author's edition of this description was published May 28, 1887.

## HYLOCICHLA USTULATA SWAINSONI (Tschudi)

## Olive-backed thrush

*Turdus swainsoni* TSCHUDI, Faun. Per., Orn., 1845-1846, p. 28. (New Jersey.)

A male collected on Swan Island, April 19, 1929, is the first record of this North American migrant on this island. The olive-backed thrush has been found casually in Cuba during migration; its regular route of migration carries it through Mexico and Central America to northern Argentina.

This specimen was indistinctly seen and was secured in the hope that it might be *Mimocichla*, which was among the desired material.

## VIREO CRASSIROSTRIS CRASSIROSTRIS (Bryant)

## Large-billed vireo

*Lanivireo crassirostris* BRYANT, Proc. Boston Soc. Nat. Hist., vol. 7, 1859, p. 112. (Nassau, New Providence Island, Bahama Islands.)

An adult male was collected on Grand Cayman, April 17, 1929. Bangs,<sup>11</sup> after comparison of a large series, has concluded that the bird of Grand Cayman, which has been recognized as *Vireo crassirostris alleni* Cory,<sup>12</sup> is not different from the highly variable typical *crassirostris* that ranges widely through the Bahamas.

The specimen secured was the only one which came under our observation. The bird was in thick underbrush, and attention was called to it by its note, which suggested that of the white-eyed vireo.

## VIREO CRASSIROSTRIS APPROXIMANS Ridgway

## Old Providence large-billed vireo

*Vireo approximans* RIDGWAY, Proc. U. S. Nat. Mus., vol. 7, July 29, 1884, p. 179. (Old Providence Island, Caribbean Sea.)

A male and a female were prepared as skins on Old Providence Island, April 24, 1929. The skull of a third specimen was preserved. As this vireo is rare in collections it is of interest to record the following measurements: Male, wing, 61.0; tail, 51.1; culmen from base, 14.5; tarsus, 21.8 mm. Female, wing, 58.0; tail, 46.9; culmen from base, 14.4; tarsus, 22.7 mm. These are the first examples of this race to come to the United States National Museum.

During certain parts of the day this vireo was an incessant singer with comparatively short, irregular intervals between songs. The specimens were taken in rather thick undergrowth bordering a stream which at that time was merely a chain of shallow pools.

<sup>11</sup> Bull. Mus. Comp. Zoöl., vol. 60, 1916, pp. 314, 315.

<sup>12</sup> *Vireo alleni* Cory, Auk, 1886, p. 500. (Grand Cayman.)

## VIREO MAGISTER CAYMANENSIS Cory

## Cayman vireo

*Vireo caymanensis* CORY, Auk, 1887, p. 7. (Grand Cayman Island, West Indies.)

Three males were collected on Grand Cayman Island, April 16 and 17, 1929, by A. K. Fisher and G. B. Pinchot. The junior author agrees with Bangs<sup>13</sup> that this bird should be treated as a race of *Vireo magister*.

The three specimens have the following measurements: Wing, 73.9, 75.4, 69.8; tail, 57.9, 57.9, 55.4; culmen from base, 16.4, 16.1, 16.5; and tarsus, 21.0, 21.2, 20.0 mm.

## VIREO OLIVACEUS GRANDIOR (Ridgway)

## Old Providence vireo

*Vireosylvia grandior* RIDGWAY, Proc. U. S. Nat. Mus., vol. 7, July 29, 1884, p. 178. (Old Providence Island, Caribbean Sea.)

Two females of this form, of which there are few specimens in museums, were taken on Old Providence Island, April 23 and 24, 1929. These are in full plumage and measure as follows: Wing, 86.0, 83.0; tail, 68.7, 65.4; culmen from base, 18.7, 19.4; and tarsus, 22.1, 21.5 mm.

Attention was attracted to this bird by a clear vireo note. One specimen was taken on a dry hillside, and the other along a partially dried stream.

## VIREO OLIVACEUS CANESCENS (Cory)

## St. Andrews vireo

*Vireosylvia canescens* CORY, Auk, May 28, 1887, p. 178. (St. Andrews Island, Caribbean Sea.)

An adult male in slightly worn plumage was taken on St. Andrews Island, April 27, 1929. It measures as follows: Wing, 87.0; tail, 68.7; tarsus, 22.2 mm. The bill is broken. This form is easily distinguished from *V. o. grandior* of Old Providence by the grayer, less greenish dorsal surface. This is the first specimen to be received by the National Museum.

This bird acted very much like a red-eyed vireo as it gleaned food among the foliage of one of the larger trees on the higher ground toward the center of the island.

<sup>13</sup> Bull. Mus. Comp. Zool., vol. 60, 1916, p. 314.

**COEREBA SHARPEI (Cory)**

## Cayman honey creeper

*Certhiola sharpei* CORY, Auk, 1886, p. 497. (Grand Cayman Island, West Indies.)

Two males were collected on Grand Cayman Island, April 16, 1929.

A very common species. It was seen everywhere from the town of Georgetown to the wilder section of the island. A pair was building a nest in a tree which stood by the building occupied as a post office.

**COEREBA OBLITA Griscom**

## St. Andrews honey creeper

*Coereba oblita* GRISCOM, Amer. Mus. Nov., No. 7, April 30, 1923, p. 7. (St. Andrews Island, Caribbean Sea.)

On St. Andrews Island on April 27, H. H. Cleaves secured a nest of a honey creeper placed 2 feet from the ground in a low shrub. This nest is the ball-shaped structure usual among these birds, with the entrance through a hole in one side. It is made of coarse grasses, dried stems of creepers, fragments of leaves, and dried seed heads of plants mixed with many shreds of cotton, and lined with finer materials. The three eggs (of which one was broken) are white, spotted with warm sepia, mars brown, and russet. One egg has a heavy wreath of markings about the large end, a second has irregular blotches over the shell, which merge to cover the large end uniformly. These two measure 19.0 by 13.0 and 19.6 by 12.9 mm. A common bird, but no specimen was collected.

**COEREBA TRICOLOR (Ridgway)**

## Old Providence honey creeper

*Certhiola tricolor* RIDGWAY, Proc. U. S. Nat. Mus., vol. 7, July 29, 1884, p. 178. (Old Providence Island, Caribbean Sea.)

An adult male and a juvenile female were taken on Old Providence Island, April 23, 1929. The adult male has the following measurements: Wing, 67.9; tail, 47.5; culmen from base, 15.5; tarsus, 20.5 mm.

On Old Providence and elsewhere in the Caribbean Islands visited the honey creepers seemed to be attracted by the collector and showed considerable interest in his movements. When specimens were to be obtained, care had to be taken to allow them to get far enough away to insure good material. A pair was building a nest in a tall slender sapling near a water hole.



**MNIOTILTA VARIA (Linnaeus)**

Black and white warbler

*Motacilla varia* LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 333. (Santo Domingo.)

Not uncommon among the undergrowth on Swan Island April 19, 1929.

**DENDROICA PETECHIA FLAVIDA Cory**

St. Andrews golden warbler

*Dendroica flavida* CORY, Auk, May 28, 1887, p. 179. (St. Andrews Island, Caribbean Sea.)

A young bird in full juvenal plumage taken on St. Andrews Island April 27, 1929, is the first of this race to come to the National Museum. This bird is somewhat worn, but as yet shows no indication of the molt into first fall plumage. The upper surface is deep mouse-gray to mouse-gray, with a wash of ecru-olive on the forehead and light yellowish-olive on the rump; wing coverts deep mouse-gray edged lightly with olive-buff; primaries and secondaries blackish, bordered lightly with light yellowish-olive; rectrices blackish, edged extensively with olive-yellow on the outer webs, and lightly with reed-yellow on the inner webs; below dull white, with a faint wash of olive-buff on breast; under tail coverts olive-buff; sides smoke-gray; inner webs of primaries edged with reed-yellow and of secondaries with whitish.

The specimen is much grayer than birds of other races of *petechia* seen in a similar stage.

In addition to the bird just described, an adult male golden warbler was collected on Old Providence April 23, 1929, that seems to be the first to be recorded from that island. Through the courtesy of the Field Museum there have been available for examination the type and other specimens on which the race *flavida* of St. Andrews was founded, with the result that the Old Providence bird is faintly paler yellow and has the crown yellow instead of rufescent. In heavy rufescent markings below it even exceeds the average of *flavida*, a race peculiar for the extent of this color on the under surface. Though these differences appear distinct, yet they are of such a nature as to be possibly within the range of individual variation, so that the Old Providence bird is identified for the present as *flavida*. This skin measures as follows: Wing, 63.8; tail, 54.5; culmen from base, 13.2; tarsus, 20.3 mm. Further material should be obtained and may easily demonstrate that the Old Providence bird is distinct.

Adult warblers were seen on St. Andrews but no attempt was made to collect them.

**DENDROICA PETECHIA EOA (Gosse)**

## Jamaican golden warbler

*Sylvicola eoa* Gosse, Birds Jamaica, 1847, p. 158. (Crab Pond, Jamaica.)

Four specimens taken on Grand Cayman, April 16 and 17, 1929, by A. K. Fisher and G. B. Pinchot, include one male and three females.

Peters,<sup>14</sup> in a revision of the golden warblers, indicates that the bird of the Cayman Islands is identical with that of Jamaica.

A common species seen everywhere in the lower growths in the localities visited.

**DENDROICA CAERULESCENS CAERULESCENS (Gmelin)**

## Black-throated blue warbler

*Motacilla caerulescens* GMELIN, Syst. Nat., vol. 1, pt. 2, 1789, p. 960. (Santo Domingo.)

Several of these warblers were seen among migratory flocks found on Swan Island April 19.

**DENDROICA FUSCA (Müller)**

## Blackburnian warbler

*Motacilla fusca* MÜLLER, Natursyst. Suppl., 1776, p. 175. ("Guyane.")

While the senior author was sitting with a companion at the edge of the beach on the east end of Swan Island, a blackburnian warbler tried to alight on the other man's hat. It fluttered about as if hunting for fresh water, hopping along the beach to inspect the little pools of salt water as if in hopes of finding one containing water fit to drink.

**DENDROICA VITELLINA NELSONI Bangs**

## Swan Island warbler

*Dendroica vitellina nelsoni* BANGS, Bull. Mus. Comp. Zool., vol. 62, January, 1919, p. 494. (Swan Island, Caribbean Sea.)

One male and two females, all in excellent plumage, were taken on Swan Island April 19 and 20, 1929.

A common species often seen in the mixed flocks of migrating warblers. In action and general appearance it called to mind the prairie warbler.

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<sup>14</sup> Proc. Biol. Soc. Washington, vol. 40, Mar. 5, 1927, p. 34.

**SEIURUS NOVEBORACENSIS (Gmelin)**

Northern water-thrush

*Motacilla noveboracensis* GMELIN, Syst. Nat., vol. 1, pt. 2, 1789, p. 958. (Louisiana and New York.)

An individual was seen at close range among the mangroves at North Cove on Grand Cayman, April 16. On April 24 two were seen on Old Providence along a shallow, canopied pool, searching for food among the pebbles. They seemed perfectly at home and as if in no hurry to reach their summer home in the north.

**SEIURUS AUROCAPILLUS (Linnaeus)**

Oven-bird

*Motacilla aurocapilla* LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 334. (Near Philadelphia, Pa.)

A few were seen on Swan Island in general company with other migrants.

**GEOTHLYPIS TRICHAS BRACHIDACTYLA (Swainson)**

Northern yellowthroat

*Trichas brachidactylus* SWAINSON, Anim. in Menag., 1838, p. 295. (Northern Provinces of United States.)

One of these little birds was seen in a small inland thicket in a coconut grove on Swan Island. As it was not collected, its allocation to the northern subspecies is solely on the basis that this is the ordinary migrant through this area.

**SETOPHAGA RUTICILLA (Linnaeus)**

Redstart

*Motacilla ruticilla* LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 186. (Virginia.)

Several were seen in different localities on Swan Island. One was flying about after insects around the buildings.

**ICTERUS LAWRENCII Cory**

St. Andrews oriole

*Icterus lawrencii* CORY, Auk, May 28, 1887, p. 178. (St. Andrews Island, Caribbean Sea.)

A pair of these beautiful orioles taken on St. Andrews Island on April 27, 1929, measure as follows: Male, wing, 108.3; tail, 90.2; culmen from base, 25.4; tarsus, 24.7 mm. Female, wing, 100.8; tail,

86.8; culmen from base, 24.7; tarsus, 25.2 mm. These are the first skins of this fine bird in the National Museum collections.

This bird is evidently of the same stock as *Icterus bairdi* of Grand Cayman, which is much lighter yellow, and *Icterus leucopteryx* of Jamaica, which is decidedly darker. The three would be considered subspecies by some workers, but in the opinion of the junior author they are sufficiently distinct to stand as species.

It was a great disappointment not to be able to see or hear *Icterus bairdi* on Grand Cayman, where we might have come in contact with this species had our limited time not prevented us from going to the extensive wild area to the eastward, which is approached only by poorly defined trails. A few days devoted to this wilderness surely would have brought reward for the extra efforts.

On St. Andrews, when the clear, alluring notes of *Icterus lawrencii* come to the ear, it is easy to understand why the step is quickened and the eye more on the alert. The attendant, on hearing the note, said it was made by the "banana bird." He further stated that during the ripening season the species did considerable damage to bananas. At this time of the year none of this fruit was available, so the birds were gleaning their food from among the treetops and taller shrubbery. Besides the two secured, one was seen and another heard.

#### HOLOQUISCALUS JAMAICENSIS CAYMANENSIS (Cory)

Grand Cayman grackle

*Quiscalus caymanensis* CORY, Auk, 1886, p. 499. (Grand Cayman, West Indies.)

Three males and one female were taken on Grand Cayman, April 16, 1929, by Gifford Pinchot and A. K. Fisher. These bear out the characters assigned by Peters in his recent revision of this interesting genus.<sup>15</sup> The female has the following measurements: Wing, 117.5; tail, 99.0; culmen from base, 27.8; tarsus, 32.2 mm. Most frequently seen in the open areas bordering the mangroves or in the coconut plantations.

#### PIRANGA RUBRA RUBRA (Linnaeus)

Summer tanager

*Fringilla rubra* LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 181. (Virginia or Carolina.)

A fine adult male of this tanager was seen with other migrants at the edge of a clearing on Swan Island.

<sup>15</sup> Auk, 1921, pp. 443, 444.

**TIARIS GRANDIOR (Cory)**

Old Providence grassquit

*Euethia grandior* CORY, Auk, 1887, p. 245. (Old Providence Island, Caribbean Sea.)

Three males, two adult and one immature, were taken on Old Providence Island April 24, and a female on St. Andrews Island April 27, 1929. The latter has the following measurements: Wing, 57.8; tail, 49.8; culmen from base, 10.0; tarsus, 18.7 mm. This well-marked form has not been represented previously in the National Museum.

This active little species was common on both Old Providence and St. Andrews. When it is working through the shrubbery or when the male flies to a point of vantage to deliver its song, it reminds one of the northern indigo bird.

**SPIZA AMERICANA (Gmelin)**

Dickcissel

*Emberiza americana* GMELIN, Syst. Nat., vol. 1, pt. 2, 1789, p. 872. (New York.)

A male was collected on Swan Island April 19, 1929, from among five or six birds seen sitting in the top of a dead tree after the manner of waxwings. The bird collected caused some surprise when it was found to be this species. Apparently the dickcissel crosses regularly over the sea in this region, since there is a previous record of two taken here March 25 and April 14, 1887, by C. H. Townsend.<sup>15a</sup>

**MELOPYRRHA TAYLORI Hartert**

Grand Cayman bullfinch

*Melopyrrha taylori* HARTERT, Nov. Zool., vol. 3, September 18, 1896, p. 257. (Grand Cayman Island, West Indies.)

An adult and two immature males, a female, and a second female preserved as a skeleton were taken on Grand Cayman April 17, 1929, by A. K. Fisher and G. B. Pinchot. One of the young males is in somewhat worn post-juvenal plumage. The other is in molt into adult dress.

Though Doctor Hartert<sup>16</sup> has recently considered the present bird a subspecies of *Melopyrrha nigra* of Cuba, the two seem sufficiently distinct to warrant specific status for *M. taylori*.

This little finch was moderately common among the shrubbery bordering roads along which we traveled.

<sup>15a</sup> Ridgway, Proc. U. S. Nat. Mus., vol. 10, August 6, 1888, p. 576.

<sup>16</sup> Nov. Zool., vol. 24, 1919, p. 154.

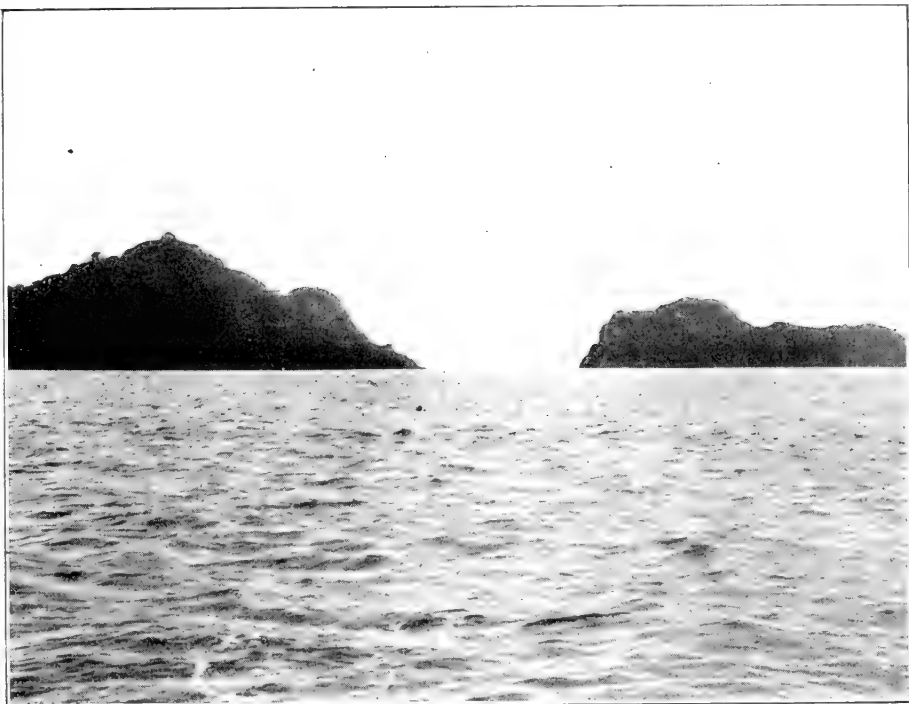
## THE BIRDS OBTAINED ON THE PACIFIC ISLANDS

After a delay because of machinery troubles at the Isthmus, the Pinchot party left Balboa on June 1 and sailed out on the Pacific. Early in the morning of June 4, Cocos Island (pl. 3) became faintly visible among low-lying clouds on the western horizon, and about noon the *Mary Pinchot* came to anchor at Chatham Bay. Cocos Island, with its deep verdure, wonderful waterfalls, and picturesque tropical appearance, was much more attractive than any of the Galapagos group, which are interesting topographically mainly on account of vagaries in outline due to their volcanic origin. Bird collecting at Cocos was carried on mainly with Chatham and Wafer Bays as bases for surrounding areas. As the long-drawn-out showers were almost equal to continual rain, shore work was difficult, so that on June 11 the yacht was headed for the Galapagos group (pls. 4 to 7).

On June 14 Tower Island was reached. From this date to August 26 the party visited, some of them more than once, the following 12 islands of the group: Tower, Indefatigable, Seymour, Daphne, Eden, Duncan, Charles, Hood, Chatham, Barrington, Albemarle, and Narborough. Of this period, over a month was consumed in making two round trips to Panama for supplies and repairs. More time was spent on Tower, Indefatigable, Charles, Chatham, and Albemarle than on the others, but on Albemarle Island little opportunity for collecting was available. At one anchorage at Indefatigable, Seymour Island was near and equally available, so that no time was lost in travel at this point. At Charles Island, anchorage was made at Black Beach and Postoffice Bay, and the interior of the island was visited by some members of the party. Work was done on this island on the last three days in June and on July 10 and 11.

Progreso, a small cluster of buildings in the upper humid reaches of Chatham Island, where cane, fruit, and coffee grow, was so attractive that the yacht anchored four times in Wreck Bay during July and August. Tagus Cove on Albemarle Island, near Narborough Island, was especially interesting as being the only place where cormorants and penguins were found. Although several days were spent near Villamiel on Albemarle, little collecting was done.

On August 26, with the Galapagos astern, the yacht headed for the Marquesas Islands, some 3,000 miles to the westward, and on the



Photograph by A. K. Fisher

COCOS ISLAND



Photograph by H. H. Cleaves

CHATHAM BAY, COCOS ISLAND



Photograph by A. K. Fisher

THE "MARY PINCHOT" AT ANCHOR, BARRINGTON ISLAND, GALAPAGOS  
GROUP



Photograph by H. H. Cleaves

SETTLEMENT AT WRECK BAY, CHATHAM ISLAND, GALAPAGOS GROUP



morning of September 11 Hivaoa and Motane came into view. Although it was originally planned to make this wonderful group one of the principal points for biological work, various delays absorbed the time so that finally only 18 days were spent among the five islands visited.

Hivaoa, Fatuhiva, Uahuka, Nukuhiva, and Eiao (pls. 8 to 10) were visited in turn, and whenever natives were met they welcomed the party and gave assistance in securing biological material. The great stretches of forest and the high mountains and towering peaks of the islands make the collector feel that great possibilities are in waiting if only time were available for full exploration. The Tuamotu group was reached on October 2 and a week was spent at the three atolls of Fakarava, Takaroa, and Toau (pl. 10). Most of the collecting was done among the coconut groves on Toau. These low-lying coral atolls are in marked contrast to the towering Marquesas, with their high volcanic peaks and numerous valleys and canyons.

The following day, after leaving the Tuamotu Islands, Papeete, Tahiti, was reached (on October 9). Collecting was then at an end, and on October 15 the party sailed on the steamship *Makura* for San Francisco.

#### SPHENISCUS MENDICULUS Sundevall

##### Galapagos penguin

*Spheniscus mendiculus* SUNDEVALL, Proc. Zool. Soc. London, 1871, p. 129. (James Island, Galapagos Archipelago.)

The two females taken were obtained at Tagus Cove, Albemarle Island, Galapagos, August 25, 1929.

Although the penguin was kept in mind, as we visited the various islands of the Galapagos group, we did not find it until we reached the narrow stretches of water between Narborough Island and Tagus Cove, Albemarle Island, late in August. In all not over a dozen were seen. The first individual noted was on an off-lying rock near the shore of Narborough Island. It was several feet above the water and slowly climbed down to escape before it could be photographed. Two others were seen in the general vicinity, and one followed by the launch kept well ahead. In manner of swimming it very closely resembled the muskrat. At a point of rock at the entrance of Tagus Cove several were seen about an eddy, and two of them were secured. They were swimming higher and in more grebe-like manner than the one above mentioned. The ovaries were dormant.

## DIOMEDEA IRRORATA Salvin

## Galapagos albatross

*Diomedea irrorata* SALVIN, Proc. Zool. Soc. London, 1883, p. 430. (Callao Bay, Peru.)

The albatross rookery on Hood Island, Galapagos group, was visited on two occasions, June 30 and July 11, and numerous photographs were taken of the birds in various positions. (Pl. 6.)

The nest, if we may designate as such the bare spot on which the egg was deposited, was placed in an open area between scattered shrubbery. Probably in most cases there were not more than half a dozen nests to an acre. It was difficult to estimate the total number, as only a few could be seen from any given point.

On the earlier trip eggs predominated, while on July 11 young were in evidence, some, although still in the down, being of good size. In the aggregate a considerable number of abandoned addled eggs were scattered over the rookery area. During the heat of the day numbers of the birds retired to the shade of the bushes, but many of the males remained close to their mates on the egg or young. In some of the more open places near shore boobies were often nesting in close proximity to the albatrosses.

The albatrosses were tame, easily approached, and even easily handled, though after a few minutes the males usually waddled away with an awkward gait. The birds when first approached frequently elevated their "eyebrows," which gave them a queer expression.

The nuptial dance was occasionally seen and differed very materially in detail from that of the Laysan albatross as noted by Dr. Walter K. Fisher in 1902.<sup>17</sup>

The birds on the nests showed no resentment when lizards or small birds came within reach of them. One bird was taken to the yacht, and when liberated fluttered clumsily to the water, whence later it took wing in the direction of home.

Except near the rookery comparatively few albatrosses were seen flying over the ocean.

## PUFFINUS LHERMINIERI SUBALARIS Ridgway

## Galapagos shearwater

*Puffinus subalaris* RIDGWAY, Proc. U. S. Nat. Mus., vol. 19, 1897, p. 650. (Dalrymple Rock, Chatham Island, Galapagos.)

Six adult birds were obtained in the Galapagos Islands as follows: Tower Island, June 15 and 16, 1929, two males and one female;

<sup>17</sup> U. S. Fish Commission Bull., 1906, vol. 23, for 1903, pt. 3, p. 787 (p. 19 of extract—Birds of Laysan and the Leeward Islands, Hawaiian group—1903).

Daphne Island, June 23, male; Hood Island, July 1, two females. Allocation of this bird as a race of *Puffinus lherminieri* is in accordance with the recent review of Murphy.<sup>18</sup>

This shearwater was a common species over the open water, at times out of sight of land, and along the nesting cliffs of all the islands of the Galapagos group that were visited. The majority of the specimens collected were taken in the vicinity of their nesting places.

When they were returning to their nesting crevices they often seemed to have difficulty in flying into the hole, and would circle around and make half a dozen attempts before succeeding. When small fish fry are driven to the surface by bonitos or other predacious fish, this shearwater often joins with the noddy tern in securing the smaller individuals. When the shoal is large they will alight at times on the surface and take the fish as they pass by.

The flight of this species is characteristic and resembles that of a swift more than it does that of its longer-winged relatives.

#### PTERODROMA PHAEOPYGIA (Salvin)

##### Dark-rumped petrel

*OEstrelata phaeopygia* SALVIN, Trans. Zool. Soc. London, vol. 9, 1876, p. 507, pl. 88, fig. 1. (Chatham Island, Galapagos Archipelago.)

Two females came aboard ship at Academy Bay, Indefatigable Island, in the Galapagos, on the night of June 8, 1929. These birds appear to be fully adult.

Mathews,<sup>19</sup> following Rothschild,<sup>20</sup> has recently revived *OEstrelata sandwichensis*, described by Ridgway from Hawaii, as a subspecies of *P. phaeopygia*, for which there may be reason. With four skins of *phaeopygia* at hand, including two from the coast of Ecuador in addition to the two listed above from the Galapagos, there is no close approach to the type of *sandwichensis* in small size of bill. The latter does not show light edgings on the feathers of the back, present in the four *phaeopygia*, although this lack is perhaps due to wear. The question is one that should be checked with additional material.<sup>21</sup>

The two females from the collections of the Pinchot expedition measure as follows:

Wing, 293.0–295.0; tail, 134.0–150.0; culmen from base, 33.3–34.0; tarsus, 37.3–38.3 mm.

<sup>18</sup> Amer. Mus. Nov., No. 276, Sept. 8, 1927, pp. 7–8.

<sup>19</sup> Syst. Av. Austr., pt. 1, 1927, p. 120.

<sup>20</sup> Av. Laysan, pt. 3, 1900, pp. 289–290.

<sup>21</sup> In this connection see Ridgway, Proc. U. S. Nat. Mus., vol. 19, 1897, pp. 648–650.

This petrel was first seen near Indefatigable Island June 21, during some rough weather, and later was observed almost daily. It seemed to frequent the open stretches more often than the Galapagos shearwater, though at times the two species were found together. Only on a few occasions did they come near enough to the yacht to be taken, and then only when it was impracticable to retrieve specimens. One evening when we were returning to anchorage from Daphne Island several hundred were seen in a rather dense, hovering group near Eden Island, where evidently they were feeding among a large shoal of small fish. On July 7, while en route to Academy Bay, Indefatigable Island, from Chatham Island, numbers were continually seen, both flying and sitting on the surface of the water. Numbers came within easy range and would have been taken had it been practicable to pick them up. Fortunately, through the kindness of Seaman LeMert Mills, two that flew aboard that night were saved and made into specimens.

The last one of these petrels was seen on August 30, several hundred miles west of the Galapagos group.

**OCEANODROMA CASTRO CRYPTOLEUCURA (Ridgway)**

Hawaiian fork-tailed petrel

*Cymochorea cryptoleucura* RIDGWAY, Proc. U. S. Nat. Mus., vol. 4, March 29, 1882, p. 337. (Waimea, Kauai, Hawaiian Islands.)

A male was secured at the Hood Island anchorage, Galapagos Islands, July 11, 1929.

Comparison of a small series of these petrels shows two races, one for the Atlantic area and one for the Pacific, as indicated by Mathews,<sup>22</sup> of which the latter, bearing the name *cryptoleucura*, ranges from the Galapagos to the Hawaiian Islands. It is distinguished from *O. c. castro* by somewhat more sooty coloration and slightly smaller size. The male from Hood Island measures as follows: Wing, 155.0; tail, 69.2; culmen from base, 15.0; tarsus, 21.2 mm.

Although stormy petrels were in evidence daily, the specimen that came aboard at Hood Island was the only one of this kind noted. Without long field experience with these birds, it is very difficult, except under unusually favorable conditions, to identify the species until they come to hand. While they are rising and dipping over the surface in unison with the motion of the waves, it is often impossible to see even such marked characters as the extended feet of the Wilson type. It is more than probable that we saw *Hydrobates tethys*, a Galapagos species, without recognizing it.

<sup>22</sup> Syst. Av. Austr., pt. 1, June 13, 1927, p. 106.



Photograph by H. H. Cleaves

SEYMOUR ISLAND, GALAPAGOS GROUP, DAPHNE ISLAND SHOWING IN THE  
DISTANCE



Photograph by H. H. Cleaves

INDEFATIGABLE ISLAND, GALAPAGOS GROUP



Photograph by H. H. Cleaves

MAN-O'-WAR BIRD, TOLIER ISLAND, GALAPAGOS GROUP



Photograph by A. K. Fisher

GALAPAGOS ALBATROSSES, HOOD ISLAND

## OCEANITES GRACILIS GALAPAGOENSIS Lowe

## Galapagos petrel

*Oceanites gracilis galapagoensis* P. R. LOWE, Bull. Brit. Orn. Club, vol. 41, July 5, 1921, p. 140. (Charles Island, Galapagos.)

Four females were obtained in the Galapagos, two on Indefatigable Island, June 22, 1929, one at Charles Island, the type locality, June 28, and one at Narborough Island, August 25. These specimens, the first of this race to come to the National Museum, bear out the characters attributed to this form in the original description, for when compared with skins from Peru the birds of the Galapagos are distinctly larger, in addition to being paler, more grayish below. In the series at hand the latter seem also to be more extensively white below, an appearance due perhaps to their slightly larger size. Following are measurements of these four: Wing, 129.2, 131.3, 131.6, 134.2; tail, 55.5, 56.8, 54.7, 61.1; culmen from base, 10.5, 10.8, 10.3, 10.5; tarsus, 30.2, 30.2, 30.6, 32.0 mm.

As more material of this species was secured, the question arises as to whether it is a commoner form than other stormy petrels, or whether the larger number taken was due merely to better opportunities for collecting. At Indefatigable Island quite a number came within long range astern, feeding on drift scrap from the yacht, and two were secured.

## PHAËTHON AETHEREUS Linnaeus

## Red-billed tropic-bird

*Phaëthon aethereus* LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 134. (Ascension Island, South Atlantic.)

On Hood Island, in the Galapagos, Gifford Pinchot secured an adult bird and a downy young only a few days old on July 1, 1929. The young bird is light gray above and white below.

Single individuals, or pairs of this tropic-bird, often were seen flying over the ocean, but rarely came near the yacht. On Hood Island a number bred in a low-lying cliff. Mr. Pinchot had a hard climb in securing the adult and young above mentioned. Another fine adult killed July 11 at Hood Island fell out of reach in the sea and drifted off shore on a strong ebb tide.

## PHAËTHON LEPTURUS DOROTHEAE Mathews

## White-tailed tropic-bird

*Phaëthon lepturus dorotheae* MATHEWS, Austr. Av. Rec., vol. 2, August 2, 1913, p. 7. (Near Cairns,<sup>23</sup> Queensland, Australia.)

A juvenile bird not quite on the wing was collected by Gifford Pinchot at the island of Fatuhiva in the Marquesas, September

<sup>23</sup> See Mathews, Birds Austr., vol. 4, pt. 3, June 23, 1915, p. 311.

17, 1929. It has the upper surface heavily barred with black and a black spot at the tips of the elongating central rectrices. It is allocated to subspecies after Mathews without critical comparison of adult skins.

Adults often were seen flying about their high nesting crags or far out over the water, but none was observed near enough to distinguish the markings.

**PELECANUS OCCIDENTALIS OCCIDENTALIS Linnaeus**

**Brown pelican**

*Pelecanus onocrotalus occidentalis* LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 215. (West Indies.)

Pelicans were abundant about Panama Bay, and as we passed out to the Pacific on June 1 almost every pile was decorated with one of these birds.

On the evening of July 17 on our return, many flocks containing from 10 to 50 individuals were seen flying toward a roosting place in the vicinity of Taboga Island. Some of these flocks passed just over the yacht and gave a good opportunity for silhouette photographs.

Around the shores and bays of the Galapagos group pelicans were common, and their clumsy but effective dive in pursuit of fish, reminding one of a keg falling overboard, was often heard or seen. At Tower Island, as we were approaching shore, a pelican almost alighted on Mr. Pinchot's head, as he stood amidships directing the course. These birds were found breeding among the mangroves on Indefatigable Island, June 24.

Pelicans were common also about Cocos Island. As no specimens were taken it is not certain whether they were the present form or the more northern California brown pelican.

**SULA LEUCOGASTRA PLOTUS (Forster)**

**Brown booby**

*Pelecanus plotus* FORSTER, Desc. Anim., 1844, p. 278. (Near New Caledonia.)

An adult female taken on Cocos Island, June 5, 1929, by A. K. Fisher, resembles birds from Polynesian localities in being distinctly darker above than specimens from the West Indies.

This species was common at Wafer Bay, Cocos Island, where undoubtedly a colony was nesting. At almost any time of day 50 or more birds were to be seen diving after their prey. They were seen also on the Chatham Bay side of the island, but were not so common there as the red-footed booby.

The species was observed at Tower Island in large numbers, and as individuals in other parts of the Galapagos group.



## SULA PISCATOR (Linnaeus)

## Red-footed booby

*Pelecanus piscator* LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 134. (Java Seas.)

A female in immature dress was taken on Cocos Island, June 5, 1929, by A. K. Fisher. No attempt is made here to distinguish subspecies in this bird.

Large numbers of this species in the so-called immature plumage were breeding on the islet Nuez at Cocos Island during the first week in June. If this is the true red-footed species in which the plumage of the adult is mainly creamy-white, with primaries blackish-brown, it is hard to understand why there were not at least a few adult-plumaged birds among the hundreds in immature dress which breed at this point. So far as memory goes, not a bird in adult plumage was seen during our entire stay in that vicinity. The species was often common about the yacht, and a few individuals came aboard at night.

## SULA NEBOUXII Milne-Edwards

## Blue-footed booby

*Sula nebourgii* MILNE-EDWARDS, Ann. Sci. Nat. (Zool.), sér. 6, vol. 13, art. 4, 1882, p. 37, pl. 14. (Pacific coast of America—probably Chile.)

A male was obtained at Indefatigable Island in the Galapagos, June 24, 1929.

In the Galapagos group this species was seen daily, usually singly, in pairs, or in small groups, never in large masses like the brown and red-footed boobies. One never tires of watching this and other species of the family diving for fish. With wings tightly pressed against the body the birds descend at an angle of 45° like a projectile, often from considerable heights, striking the water with a thud and reappearing at the surface 8 or 10 feet beyond as if following a parabolic curve. One afternoon at Wreck Bay, Chatham Island, five boobies of this species gave a fine exhibition, descending in almost perfect alignment to strike the water and reappear together. After a moment's rest they arose in a half spiral to regain position for another onslaught on their prey. This maneuvering over a rather restricted area was kept up for fully half an hour.

One of the natives on Chatham Island had a booby which he was carrying home for food, and we understand that these birds are considered quite a delicacy.

## SULA VARIEGATA (Tschudi)

## Peruvian booby

*Dysporus variegatus* TSCHUDI, Arch. Naturg., 1843, p. 390. ("In littoribus et insulis Oceani pacifici.")

A female in adult plumage was obtained on Tower Island in the Galapagos Archipelago June 14, 1929.

This species, first seen at Tower Island, was found later to be quite common about Indefatigable, Daphne, Chatham, and Hood Islands. It is a fine-appearing bird and suggests the gannet more than the booby type.

## NANNOPTERUM HARRISI (Rothschild)

## Flightless cormorant

*Phalacrocorax harrisi* ROTHSCILD, Bull. Brit. Orn. Club, vol. 7, May 25, 1898, p. lii. (Narborough Island, Galapagos Archipelago.)

Two males and three females were obtained at Narborough Island in the Galapagos August 25, 1929, two being preserved as skeletons and the others as skins. Doctor Fisher found that two males weighed 9 pounds each, and two females 6 pounds each, a surprising sexual difference in bulk.

Two sets of two eggs each were obtained by Mr. Pinchot on the same date from rather large nests made compactly of seaweed. One had been abandoned. The eggs are pale glaucous-blue, this color being entirely concealed and covered by a chalky-white deposit over the entire shell, so that the underlying color may be seen only by chipping this cover layer away. The eggs are much nest-stained. The two sets measure as follows: 65.1 by 41.8 and 69.4 by 41.2; 65.9 by 42.5 and 70.2 by 42.7 mm. These figures agree with those given by Rothschild and Hartert.<sup>24</sup>

On August 25 after crossing in the launch from Tagus Cove, Albe-marle Island, to Narborough Island, we almost immediately ran across five of these cormorants on a rocky point some 8 feet above the water. After photographs were taken, specimens were secured. The birds are very tame and seem little affected by approach either on land or on the water. As we scouted along shore quite a number were seen both on the rocks and in the water. When moving they jump with both feet together and body erect much as a small child will do while descending steps. They are expert swimmers, and often hunt or follow their prey for 50 yards or more under water before coming to the surface.

When we returned to Tagus Cove anchorage, a number of pairs were found breeding on a low shelf of rock. The nests were com-

<sup>24</sup> Nov. Zool., vol. 9, July, 1902, p. 409.

pect and made of fine drift seaweed. An interesting question is why this species is so unevenly restricted when so many suitable, widely separated places exist; also why, with the exception of this small colony, no cormorants were seen between Panama and the entrance of San Francisco Bay on our long 7,500-mile trip through the South Seas.

**FREGATA MAGNIFICENS Mathews**

Frigate bird, man-o'-war bird

*Fregata minor magnificens* MATHEWS, Austr. Av. Rec., vol. 2, December 19, 1914, p. 120. (Barrington Island, Galapagos Archipelago.)

A male and a female taken on Cocos Island June 5, 1929, by A. K. Fisher, are immature birds, with the head, neck, and upper breast suffused with brown. The light wing bar in both is pale, and stands out in marked contrast to the darker feathers of the wing.

Some form of this bird of wonderful flight was seen at every island encountered between Cocos Island and Tahiti.

They would often follow the yacht, soar above it, or even alight on its higher rigging, and on occasion it was feared they might injure the radio outfit by alighting on it. At Tower Island, every morning 50 or more females would leave the males to attend to the nests and would fly out to the vessel to circle about in graceful curves for a time and then return to the island. At the nesting colony on Tower Island (pl. 6), the birds were easily approached, and after a few preliminary half-hearted thrusts at the intruder, would allow themselves to be stroked with the hand. On one occasion a male, in his first excitement at being approached, disgorged some fish that he evidently had taken from boobies. In feeding habits they have two very dissimilar methods of procuring food, namely, as robbers and as scavengers. As pirates they rob other birds of fish just captured, and as scavengers they pick morsels from the ocean surface. When taking food from the water the wing tips are thrown upward with wonderful grace as the bird poises for a moment, while reaching downward with extended neck. The booby appears to be the most frequent victim upon which these great birds practice piracy. When boobies find shoals of fish and are feeding in numbers, the man-o'-war birds are sure to be hovering near to secure their unjust share of the chase. Some individual boobies seem to have acquired prudence, and after catching fish, remain on the surface long enough to be forgotten by their persecutors before taking wing to resume their pursuit of food. The man-o'-war bird also robs the noddy, and at times pursues the little stormy petrel. The question is whether the petrel also would be devoured if the man-o'-war should catch up with it.

This bird does not seem to be able to carry anything weighty in its beak. It has been seen to pick up and let fall objects that would give gulls little trouble to carry. Near Chatham Island one picked up a small object and let it fall a dozen times before becoming discouraged and abandoning it.

There seems to have been a great mortality among the man-o'-war birds, for in all the nesting places visited many skeletons were found on the nests or on the ground underneath. No evidence of such marked mortality was found among boobies and other species nesting in the vicinity.

**ARDEA HERODIAS COGNATA** Bangs

Galapagos blue heron

*Ardea herodias cognata* BANGS, Proc. New England Zool. Club, vol. 3, February 6, 1903, p. 100. (Indefatigable Island, Galapagos Islands.)

Great blue herons were seen at Tower and Indefatigable Islands, and at Postoffice Bay, Charles Island, at a lagoon, one allowed itself to be approached to within 10 feet, when it flew and alighted again a short distance away. With their formidable bills these great birds have probably trained the dogs and cats which roam the islands to have proper respect for them.

**CASMERODIUS ALBUS EGRETTE** (Gmelin)

American egret

*Ardea egretta* GMELIN, Syst. Nat., vol. 1, pt. 2, 1789, p. 629. (Cayenne.)

One was reported seen on Tower Island, June 15. None was found on Albemarle Island where it has been stated they have bred.

**DEMIGRETTE SACRA SACRA** (Gmelin)

Reef heron

*Ardea sacra* GMELIN, Syst. Nat., vol. 1, pt. 2, 1789, p. 640. (Tahiti.)

A female collected at Eiao in the Marquesas Islands on September 28, 1929, is entirely in dark plumage except for the white throat.

This species was found sparingly in the Marquesas and Tuamotu group. On Fatuhiva, one was seen well back among the hills along a stream, while the one secured at Eiao was feeding on the outlying tide rocks. No individual in the white phase of plumage was observed. Although noted about at sunset its pernoctalian traits were not as marked as in our night heron. At Toau, Tuamotu Island, as we passed a cabin, a tame one of this species was persistent in its attempt to follow us. Mild discipline had no effect on it, so the owner laughingly had to pick it up and carry it home. The native name was "gay-too-sir." Later this bird was seen in the cabin associated with the children, and on the outside with chickens

that displayed due respect for it. A pig that ill advisedly planned to appropriate a piece of food which the bird was eating had a rapid change of heart, evinced by his quick retreat, sudden squeal, and the shaking of his head.

**BUTORIDES VIRESCENS HYPERNOTIUS** Oberholser

Panama green heron

*Butorides virescens hypernotius* OBERHOLSER, Proc. U. S. Nat. Mus., vol. 42, August 29, 1912, p. 549. (Rio Indio, near Gatun, Canal Zone.)

An adult male taken on Cocos Island June 6, 1929, by A. K. Fisher agrees with *hypernotius* in size but is slightly lighter on the abdomen than our series of that bird. As the skins of the Central American bird seen are somewhat stained by grease it appears that the difference noted is probably adventitious. Gifford<sup>25</sup> observed that the green heron was found in small numbers on Cocos Island in September, 1905, and recorded that in size his specimens are smaller than those of California (*B. v. anthonyi*). The present specimen bears out this statement and indicates that the bird is the Panamanian form, which ranges from central Costa Rica through the Canal Zone to Colombia. The skin in hand has the following measurements: Wing, 171.5; tail, 62.3; exposed culmen, 58.9; tarsus, 51.1 mm. The claws are worn blunt at the ends, indicating probably that the bird walked about much on stones.

Two individuals only of this heron were seen at Cocos Island. One at Chatham Bay flew up from the small boulders at the mouth of a stream where it crossed the beach, before the boat landed. After we reached shore we looked for it but it could not be found, nor was it seen on subsequent trips. The specimen secured at Wafer Bay was taken in a swampy tract a short distance back from the beach. It evidently had been feeding recently as its gullet contained three good-sized fish (*Sicydium*).

**BUTORIDES SUNDEVALLI** Sharpe

Galapagos heron

*Butorides sundevalli* SHARPE, Cat. Birds Brit. Mus., vol. 26, 1898, p. 185. (James Island, Galapagos Archipelago.)

Two specimens were taken in the Galapagos, an immature male at Tower Island June 14, 1929, and an adult female at Duncan Island June 26. The young bird is quite distinctly streaked below.

The Galapagos heron was seen almost daily along the low lava reefs or at the edges of tide pools, where it was so tame it could easily be approached. The specimen from Duncan Island was taken by LeMert S. Mills, an active young seaman, who caught it as he landed from a skiff.

<sup>25</sup> Proc. California Acad. Sci., vol. 2, Aug. 11, 1913, pp. 65, 66.

One morning on Indefatigable Island while we were on a beach, Seaman Ralph Nelson began to break up a crab (*Grapsus*) with a staff, to ascertain whether it contained edible meat. A Galapagos heron had been feeding among the rocks, and had paid no apparent attention to us, but when it saw the crab being broken the bird came running up to where we were standing. To find out what it would do, we quietly backed off, when the bird immediately approached the crab, looked it over without touching it, and then, satisfied, walked back to its feeding-ground. When the pounding of the crab was resumed, the heron raced back again, this time stopping between us only a foot or two away. First it would look at the crab and then up at our faces as if asking what all this affair was about. Its bewildered expression was very amusing.

**NYCTANASSA VIOLACEA PAUPER** (Sclater and Salvin)

Galapagos night heron

*Nycticorax pauper* SCLATER and SALVIN, Proc. Zool. Soc. London, 1870, p. 327. (Indefatigable Island, Galapagos Archipelago.)

Four specimens were collected in the Galapagos, two immature females at Tower Island June 14 and 16, 1929, an adult male at Daphne Island June 23, and an immature male at Tagus Cove on Indefatigable Island August 25. These are all appreciably darker than the typical form and seem to be easily separable as a distinct race.

This was not an uncommon species on all of the Galapagos Islands visited by us, the immature birds being much in evidence. On Tower Island a certain adult, when approached, reminded one of a road-runner as it ran into a thick clump of shrubbery, whence it would not flush.

**PHOENICOPTERUS RUBER** Linnaeus

Flamingo

*Phoenicopterus ruber* LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 139. (Jamaica, Cuba, and Bahamas.)

Although reported by natives, the only one seen was a young bird in a dooryard at Villamiel, Albemarle Island, which recently had been captured not far distant.

**DAFILA GALAPAGENSIS** (Ridgway)

Galapagos pintail

*Poecilometta galapagensis* RIDGWAY, Proc. U. S. Nat. Mus., vol. 12, February 5, 1890, p. 115. (Charles Island, Galapagos Archipelago.)

On June 24 one of these ducks was seen at close range on a lagoon on Indefatigable Island. A few flying birds were reported by members of the party from time to time, but this was the only one near enough to show any pattern.



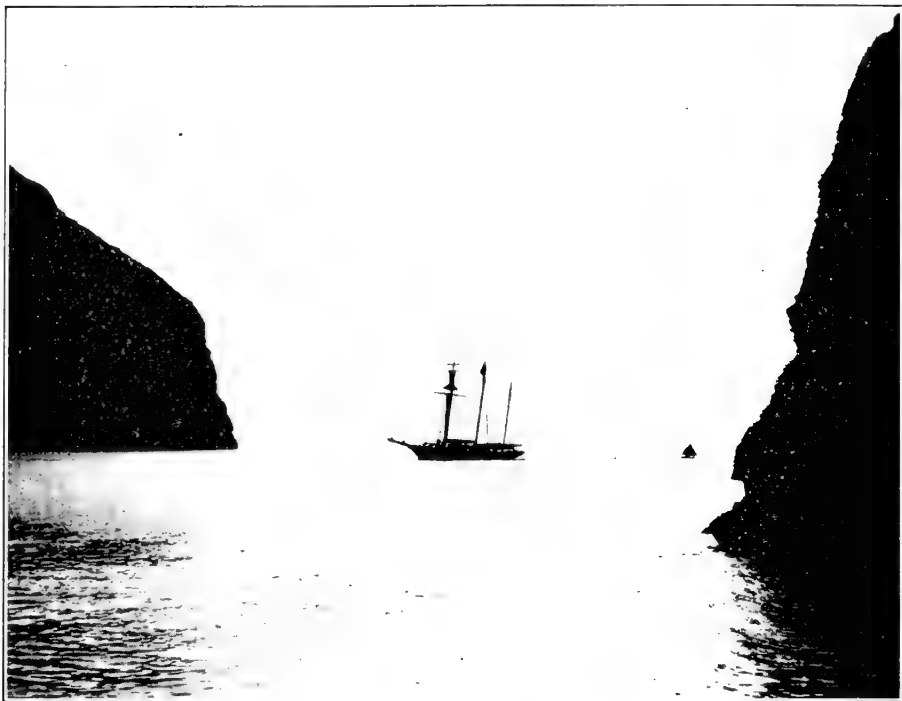
Photograph by H. H. Cleaves

INDEFATIGABLE ISLAND, GALAPAGOS GROUP



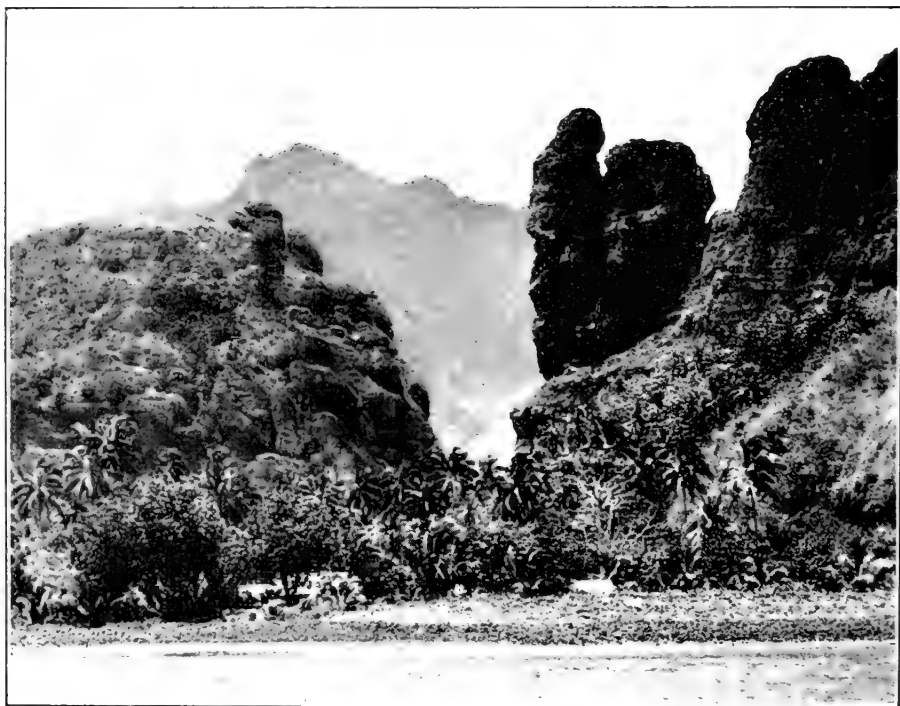
Photograph by A. K. Fisher

GALAPAGOS HAWK AT NEST, SEYMOUR ISLAND



Photograph by A. K. Fisher

THE "MARY PINCHOT" IN HARBOR, BAY OF VIRGINS, FATUHIVA, MARQUESAS ISLANDS



Photograph by H. H. Cleaves

FATUHIVA ISLAND, MARQUESAS ISLANDS



## BUTEO GALAPAGOENSIS (Gould)

## Galapagos hawk

*Polyborus galapagoensis* GOULD, Proc. Zool. Soc. London, October 3, 1837, p. 9. (Galapagos Islands.)

This interesting hawk, the only species of its family known to inhabit the Galapagos group, was seen on all the larger islands visited except Tower Island, where very likely it simply escaped notice. In size and in other respects it suggests our broad-winged hawk. Its nests were found on Seymour, Indefatigable, and Hood Islands, and at this season were empty except for an addled egg found on Seymour. The nests were placed on lava outcrops and on account of their size and elevation could be seen at a considerable distance. (Pl. 7.) They were at least  $3\frac{1}{2}$  feet in diameter and about the same in height, much like a well-formed haystack but not so rounded on top. The mass was made up of tree branches, bits of weed stalks, and other rubbish, with finer material on top, bearing a shallow depression. As the birds were seen on and in the vicinity of the nests at frequent intervals, it is likely that the breeding season was approaching.

Polyandry, at least among North American birds of prey, seems to be unknown. It was of great interest, therefore, to find a female of the Galapagos hawk receiving sexual advances from two males. A female and two males were seen quite frequently about a nest on Seymour Island or flying in sight of one another in search of food. On June 20 all three birds were present in the vicinity of the nest, the female sitting on one of the larger trees, 35 to 40 yards distant. While the observer was quietly stationed near the nest, one of the males flew and alighted on the limb close to the female. Almost immediately they began their courtship and sexual union soon was accomplished. The male then flew and alighted near the observer, while almost immediately his place at the side of the female was taken by the second male. Very soon his mating advances were received as had been those of his predecessor and their connubial relations were completed. There was no indication of jealousy on the part of either male, and the birds departed at different times but flew in the same general direction.

These hawks were very tame and showed no fear when approached within a few feet. They were photographed in both still and moving pictures, and the operator stood not over a yard away. Once to induce a hawk to leave a tree and go to its nest to be photographed, it was necessary to climb the tree and push the hawk off the limb by placing the muzzle of a gun against its underparts. On Hood Island, Doctor Mathewson fed lizards to a hawk by presenting them attached to a short stick. When the hawk had difficulty in detaching the preferred morsel with its beak it used its foot suc-

cessfully. On Indefatigable Island one of these hawks was seen to drop on prey and almost immediately arise with a lizard in its talons. Chief Engineer Christenson killed a hawk with a rifle, and its stomach contained the remains of a dove. This would seem to be unusual, because birds, even the ground finches, showed little fear of the hawks.

**PANDION HALIAETUS CAROLINENSIS (Gmelin)**

Osprey

*Falco carolinensis* GMELIN, Syst. Nat., vol. 1, pt. 1, 1788, p. 263. (Carolina.)

An osprey was seen on several occasions at Wafer Bay, Cocos Island, June 5-10, as it flew back and forth over the water.

**GALLUS GALLUS (Linnaeus)**

Jungle fowl

*Phasianus gallus* LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 158. (Pulau Condor, off mouth of Mekong River.)

An adult female and a chick in the down were secured on Uahuka in the Marquesas, September 23, 1929. The chick, with only a trace of the juvenal plumage appearing at the sides of the breast, has the wings developed so that the tips of the primaries in the made-up skin extend beyond the tail. The wing feathers are firm and strong and the bird quite evidently was able to fly.

This species, which was introduced into the Marquesas Islands in the early days, has spread and become feral in the wilder parts. It seemed strange to hear the cock crowing in localities far from human habitation. The jungle fowl is hunted by the natives and has become somewhat wary.

**HAEMATOPUS PALLIATUS GALAPAGENSIS Ridgway**

Galapagos oystercatcher

*Haematopus galapagensis* RIDGWAY, Auk, 1886, p. 331. (Chatham Island, Galapagos Archipelago.)

A male was taken at Indefatigable Island in the Galapagos, June 20, 1929.

Anywhere on the islands of the Galapagos group where there are low-lying reefs uncovered by the tide, we were almost sure to run across one or two to half a dozen of these interesting birds. With a little caution it was possible to walk among a group of oystercatchers, the lack of fear making them very different from their wary relatives on our Atlantic seaboard. Unless one tried to get within a few feet of them little attention was paid to the oncomer, as they busied themselves in procuring food from the reefs recently

uncovered by the ebbing tide. At times a bird would stand motionless on one foot for many minutes as if to rest, and it was surprising to note how inconspicuous they often were, especially when little sand pockets occurred among the dark masses of rock. The dark upperparts and light underparts blended so perfectly with the shore-line landscape that the outline of the bird was lost until possibly the red bill betrayed them.

**CHARADRIUS SEMIPALMATUS Bonaparte**

Semipalmated plover

*Charadrius semipalmatus* BONAPARTE, Journ. Acad. Nat. Sci. Philadelphia, vol. 5, 1825, p. 98. (Coast of New Jersey.)

A female taken at Wafer Bay, Cocos Island, June 5, 1929, marks another migrant species nesting in the north that does not seem to have been recorded previously from this island.

Mr. Cleaves reported seeing this plover with the black-bellied plover on Indefatigable Island, June 17, the only record other than the specimen taken on Cocos Island.

**PLUVIALIS DOMINICUS FULVUS (Gmelin)**

Pacific golden plover

*Charadrius fulvus* GMELIN, Syst. Nat., vol. 1, pt. 2, 1789, p. 687. (Tahiti.)

A female was collected on Eiao in the Marquesas group, September 28, 1929.

Eiao Island is an elevated table-land with parts of its sides made up of almost perpendicular walls over 2,000 feet high. The escarpment has been broken down in some places, one of which bears a steep trail leading up to the summit. The top is an interesting, rolling plateau, cut in places by broad but rather shallow valleys, and bearing here and there clumps of woodland. On the open knolls and slopes where the introduced sheep had closely trimmed the turf we flushed a flock of 15 or more golden plovers and an occasional tattler which seemed much out of place. This open stretch of several hundred acres uniformly showed shorebird droppings, which would seem to indicate that a large number had recently held rendezvous here before passing onward.

**ARENARIA INTERPRES OAHUENSIS (Bloxham)**

Pacific turnstone

*Tringa oahuensis* BLOXHAM, Byron's Voy. Blonde to the Sandwich Islands, 1826 (publ. February 20, 1827), p. 251. (Hawaiian Islands.)

Two specimens, male and female, were obtained on Tower Island in the Galapagos June 15, 1929. Both are in worn winter dress, the male showing some advance toward breeding plumage about the head.

In addition to those taken on Tower Island, five turnstones were seen on a dry slough on Seymour Island June 21; four on a reef at Daphne Island June 23; and three on Hood Island on July 1.

**NUMENIUS HUDSONICUS** Latham

Hudsonian curlew

*Numenius hudsonicus* LATHAM, Index Orn., vol. 2, 1790, p. 712. (Hudson Bay.)

Two of these curlews, with five turnstones, seen June 21 on a dry lagoon on Seymour Island, were the only ones observed during the trip.

**HETEROSCELUS INCANUS** (Gmelin)

Wandering tattler

*Scolopax incanus* GMELIN, Syst. Nat., vol. 1, pt. 2, 1789, p. 658. (Eimeo, or Moorea, Island, Society group, and Palmerston Island, Pacific Ocean.)

A male was taken at Wafer Bay on Cocos Island June 5, 1929, by A. K. Fisher. This specimen is in winter dress at a time when its companions in Alaska are beginning to nest and so would seem to represent an abnormal individual that had lacked physiological incentive for the northward migration.

Snodgrass and Heller<sup>26</sup> record one as seen in Chatham Bay, Cocos Island, in July. This species was found again in fall in the Marquesas, where an adult male, still partially in breeding dress, was taken on Uahuka September 19, and an adult and an immature bird were shot on Eiao September 28.

The wandering tattler was noted in the Galapagos Islands at Indefatigable Island, at Daphne June 23, and at Hood Island July 1. At Eiao Island of the Marquesas group it seemed very odd to find individuals on the high, dry plateau at an altitude of over 2,000 feet, and others on the low reefs on the shore of the island. In the Tuamotu Islands this species was seen at Takaroa October 1, and at Toau October 4. On this latter atoll it also was found at little ponds away from the shore where in action and flight it suggested the solitary sandpiper.

**PISOBIA FUSCICOLLIS** (Vieillot)

White-rumped sandpiper

*Tringa fuscicollis* VIEILLLOT, Nouv. Dict. Hist. Nat., vol. 34, 1819, p. 461. (Paraguay.)

A female taken at Wafer Bay, Cocos Island, June 5, 1929, is in breeding plumage. The date is late for occurrence of this migrant.

<sup>26</sup> Proc. Washington Acad. Sci., vol. 4, Sept. 30, 1902, pp. 511-512.

The specimens collected of the wandering tattler, semiplanted plover, and this species were found feeding on the bare flats at low ebb at Wafer Bay.

**HIMANTOPUS MEXICANUS (Müller)**

Black-necked stilt

*Charadrius mexicanus* MÜLLER, Natursyst. Suppl., 1776, p. 117. (Mexico.)

A black-necked stilt, with its young, was seen on a beach on Indefatigable Island June 17-20.

**PHALAROPUS FULICARIUS (Linnaeus)**

Red phalarope

*Tringa fulicaria* LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 148. (Hudson Bay.)

A female molting from nuptial to first fall plumage taken at Narborough Island August 25, 1929, is apparently the first record of the species for the Galapagos. According to Bent,<sup>27</sup> the fall migration of the red phalarope begins off the coast of California in July or early August, so that the date of taking of the present specimen would seem to be usual.

When we were sailing between Albemarle and Narborough Islands the water was very smooth, and among other things we saw large numbers of phalaropes for the first and only time. Mr. Cleaves estimated that the total was not far from 2,000. Later in the day while we were in the launch, one of these birds was secured, and identification made sure.

**LARUS FULIGINOSUS Gould**

Sooty gull

*Larus fuliginosus* GOULD, Zool. Voy. Beagle, pt. 3, Birds, March, 1841, p. 141. (James Island, Galapagos Archipelago.)

A male was secured at Tower Island June 14, 1929.

This gull was seen at every island we visited in the Galapagos group. It was common, associated with the fork-tailed gull, along the rocky ledges, it was grouped in numbers on the sandy beaches, and it often visited the vessel, especially when food refuse was being thrown overboard. At Tower Island two or three dozen congregated on the beach where a manta was being dissected, and fed with great relish on the discarded scraps.

The general appearance of this species, together with its manner of flight, its close grouping on the beaches when at rest, and method of feeding, continually brings to mind Heermann's gull, which it

<sup>27</sup> U. S. Nat. Mus. Bull. 142, 1927, p. 13.

resembles quite closely. It was not so tame as the fork-tailed gull and did not give the same opportunity for photographic work. At Villamiel, Albemarle Island, where the buildings are near the beach which lies behind the reefs, the gulls use the tops of the homes as resting and lounging places, a habit so common among the relatives at northern seaports.

This colony of gulls seemed to have adopted a new and rather effective method of procuring food with little effort to themselves. The shallow stretch of water that lies between the beach and the reefs is used by a number of pelicans for fishing purposes. While watching their awkward but effective diving we were surprised and amused to see hovering gulls alight on the heads of the pelicans that had made successful catches. For some reason, in a few moments the pelican opened its mouth, when the gull adroitly removed a portion of the catch and flew away with it. During half an hour several gulls were seen to perform this trick. This was not observed elsewhere.

**CREAGRUS FURCATUS (Neboux)**

**Fork-tailed gull**

*Larus furcatus* NEBOUX, Zool. Voy. Venus, Atlas, 1842, pl. 10. ("Monterey," California.)

A male was taken at Tower Island, June 14, 1929.

The type locality of Monterey assigned to this species is probably erroneous. The species was described from the collections obtained on the voyage of the *Venus*, and it is suggested that the bird was obtained while the ship was en route from the Galapagos to California.

To those who have lived where gulls are numerous both as to individuals and as to species, and where perplexing immature plumages are often confusing, a vague feeling of disappointment comes as they sail a sea without gulls. When we left Panama behind, gulls faded away astern and we saw no more until we were approaching Tower Island of the Galapagos group. We still were several hours away when a pair of beautiful fork-tailed gulls met the yacht, circled around it several times, and then started on their return as if to pilot us to the island. When we sailed to the westward from the Galapagos not another gull was seen over the stretch of 7,000 miles traveled, until we were within a few hours of the journey's end, when gulls began to come out to us, as the Farallons, off Golden Gate, became visible through the haze.

The fork-tailed gull was seen at all of the Galapagos Islands visited, and whenever rocky ledges were approached they appeared in numbers usually associated with the sooty gull, the only other species found in the region.

They were very tame and unsuspicious and showed little fear when approached. Mr. Cleaves, while taking moving pictures of them at Hood Island, was forced to push some individuals out of the field, as they were obstructing the foreground. When a gun was discharged near by they circled about for a few moments and then returned to their resting places. They utter rather plaintive notes, compared with the harsh rasping calls of their northern relatives. This species, with its delicately colored plumage, graceful flight, and interesting habits, may be considered one of the most attractive of the whole group.

**STERNA FUSCATA OAHUENSIS Bloxham**

Pacific sooty tern

*Sterna Oahuensis* BLOXHAM, Byron's Voy. Blonde to the Sandwich Islands, 1826 (publ. Feb. 20, 1827), p. 251. (Hawaiian Islands.)

An adult male, taken at Uahuka in the Marquesas Islands September 24, 1929, measures as follows: Wing, 268.0; tail, 185.5; culmen, 41.2; tarsus, 22.0 mm. Sooty terns from the Pacific islands, according to Mathews,<sup>28</sup> have longer "streamers" or outer tail feathers than those from the West Indies, and in the small series compared at this time appear to the junior author, in addition, to be more sooty black above. They are separated as a distinct race under the name given above.

At the same island of Uahuka, two juvenile birds were taken on September 19 and 24, one of them about one-half grown and the other with wings developed to a point where it must have had the power of flight.

The sooty tern was seen casually in the Galapagos, Marquesas, and Tuamotu groups, as individuals or small flocks now and then passed the yacht at some distance. When we reached Uahuka in the Marquesas, however, an immense colony was found on Hat Island—a flat-topped island of 10 acres or more in extent, with perpendicular walls varying in height from 15 to 30 feet above the ocean surface. Those who climbed to the top, with the aid of a rope fastened above by a native, found the birds at their nests so closely associated that it was difficult to walk without stepping on eggs or young. The birds, as they arose in great masses, made a deafening noise that could be heard a mile or more away. Some of the young, in scrambling about, frequently fall into the sea and, according to statements of natives, are soon eaten by groupers or other larger fish. In fact, the natives are said to use them as bait. The small one made into a specimen was picked up soon after it fell into the water. Almost at any time of night these terns were heard flying about the vessel.

<sup>28</sup> Birds Austr., vol. 2, pt. 4, Nov. 1, 1912, p. 394.

The rats, which were numerous on the island, destroyed eggs and young, and before we left, a supply of poisoned grain was scattered about to reduce the numbers of these rodents.

**THALASSEUS BERGHII RECTIROSTRIS (Peale)**

Crested tern

*Sterna rectirostris* Peale, U. S. Expl. Exp., vol. 8, 1848, p. 281. (Fiji Islands.)

An adult male in breeding dress was obtained at Toau, in the Tuamotu group, October 4, 1929. The only other specimens available from the Pacific area are in post-breeding dress, two in this stage from Makemo Island in the Tuamotus being distinctly paler above than this adult. The skin from Toau has the following measurements: Wing, 343.0; tail, 163.0; culmen, 59.0; tarsus, 28.4 mm.

This fine tern was seen almost daily at the Tuamotu Islands, but not elsewhere.

**PROCELSTERNA CERULEA CERULEA (F. D. Bennett)**

Gray noddy

*Sterna cerulea* F. D. BENNETT, Narr. Whaling Voy., vol. 2, 1840, p. 248. (Christmas Island and other low coral formations of the Pacific.)

The two specimens taken include a male from Uahuka in the Marquesas, September 19, and a female from Toau in the Tuamotus, October 5, 1929. The bird from the Marquesas is darker than the other and it is possible that the two are subspecifically distinct, but with only limited material at hand it is not practicable at this time to separate them. Following are measurements: Male, wing, 175.0; tail, 97.0; culmen, 27.0; tarsus, 24.7 mm. Female, wing, 175.0; tail, 93.8; culmen, 26.0; tarsus, 23.8 mm.

Mathews<sup>29</sup> is unquestionably in error in lumping birds from Christmas Island, the type locality of *cerulea*, with those of the Hawaiian Islands. On turning to the original description of *cerulea*, we read "plumage light blue or slate colour," which agrees with the darker birds of the south but would hardly apply to the paler ones of the Hawaiian Islands, which have the breast nearly white. A skin seen in the British Museum, taken on Christmas Island "with egg," October 6, 1884, a topotype of *cerulea*, is closely similar to birds from the Marquesas, and is decidedly darker than Hawaiian specimens.

The specimen of this lovely little tern taken at Uahuka was collected some distance inland from the shore, but others were seen

<sup>29</sup> Birds Austr., vol. 2, pt. 4, Nov. 1, 1912, p. 431; Syst. Av. Austr., pt. 1, June 13, 1927, p. 144.



about some steep cliffs, where they may have been breeding. Certain phases of their flight strongly suggest that of the nighthawk.

At Toau the only one seen was the specimen taken.

**MEGALOPTERUS MINUTUS MINUTUS (Boie)**

Pacific white-capped noddy

*Anous minutus* BOIE, Isis, 1844, p. 188. (Nova Hollandia=Raine Island, Northeast Australia.<sup>50</sup>)

Two males and a female from Toau, in the Tuamotu group, taken October 5 and 6, 1929, measure as follows: Males, wing, 226.0, 224.0; tail, 117.8, 115.8; culmen, 42.5, 45.3; tarsus, 20.4, 21.3 mm. Female, wing, 228.0; tail, 120.8; culmen, 42.6; tarsus, 21.0 mm.

Various names are at present current for birds of this species from various parts of the Pacific area, some of which certainly are not valid. With material lacking from many of the localities concerned it is not practicable at this time to attempt definite revision of the group but as has elsewhere been stated,<sup>31</sup> birds from the area south of the Hawaiian group, Wake, Marcus, and the Caroline Islands apparently should be known as *Megalopterus minutus minutus* (Boie) with a range from eastern Australia across to the Tuamotus, and possibly Cocos Island, since there is little evident in available descriptions and in the few specimens seen to distinguish geographic races in this region. The single bird at hand from Cocos Island, a female taken June 6, 1929, by A. K. Fisher, which should represent the race *diamesus*,<sup>32</sup> differs from skins from the Tuamotus only in being faintly lighter than most, a difference so slight as to be apparently individual. This specimen has the following measurements: Wing, 230.0; tail, 123.5; culmen, 42.5; tarsus, 20.8 mm.

**ANOÛS STOLIDUS PILEATUS (Scopoli)**

Pacific noddy

*Sterna pileata* SCOPOLI; Del. Flor. Faun. Insubr., pt. 2, 1786, p. 92. (Philippines.)

Two females were obtained, one at Nukuhiva in the Marquesas September 26, and one at Toau in the Tuamotus October 5, 1929. The skin from Nukuhiva has the following measurements: Wing, 283.0; tail, 167.0; culmen, 39.6; tarsus, 23.7 mm.

The specimen from Toau is in partial molt. The two species of noddies observed at Toau, Tuamotu Islands, were common and in

<sup>50</sup> See Mathews, Syst. Av. Austr., pt. 1, June 13, 1927, p. 146.

<sup>31</sup> Wetmore, Alexander, Ibis, 1925, pp. 826, 827.

<sup>32</sup> *Micranous diamesus* Heller and Snodgrass, Condor, 1901, p. 76. (Cocos Island.)

about the same numbers. In flight the two forms intermingled, but were readily distinguished by their size, color, and crown patch.

**ANOÛS STOLIDUS RIDGWAYI** Anthony

Ridgway's noddy tern

*Anous stolidus ridgwayi* ANTHONY, Auk, 1898, p. 36. (Socorro Island, Mexico.)

The single specimen taken on Cocos Island June 6, 1929, by A. K. Fisher, is a bird in molt without the light crown cap. This individual is renewing the primaries. It is identified as *ridgwayi* in accordance with present usage, though no particular difference is noted in comparing it with skins of *A. s. galapagensis* from the Galapagos Islands, since it is as dark as the average of that race.

**ANOÛS STOLIDUS GALAPAGENSIS** Sharpe

Galapagos noddy

*Anous galapagensis* SHARPE, Phil. Trans., vol. 168, 1879, p. 469. (Dalrymple Rock, Chatham Island, Galapagos Islands.)

A male was secured at Tower Island June 14, 1929.

When we were near islands, noddies of one form or another were common along the rocky ledges or out over the water, where they were in search of food. Often large flocks were seen milling over shoals of fish, especially when bonitos or other predacious fish were driving small fry toward the surface. In the fading light of evening or when the noddies were flying with a dark shore as a background, often the only part of each bird visible was the light crown patch that bobbed along like a will-o'-the-wisp.

**GYGIS ALBA CANDIDA** (Gmelin)

Fairy tern, love tern

*Sterna candida* GMELIN, Syst. Nat., vol. 1, pt. 2, 1789, p. 607. (Christmas Island, Pacific Ocean.)

Two adult males and a nestling with wing quills just starting were taken on Cocos Island June 10, 1929, by A. K. Fisher. The adults have the following measurements: Wing, 236, 247; tail, 106.0, 125.7; culmen, 38.1, 38.9; tarsus, 13.9, 13.4 mm. These birds seem to agree in range of measurement with a few skins at hand from the Tuamotu Islands and Tahiti, and on this basis are supposed to represent the form typical of the central Pacific region.

A male taken at Toau in the Tuamotus has the following measurements: Wing, 240.0; tail, 119.3; culmen, 43.0; tarsus, 12.8 mm.

Hartert<sup>33</sup> believes, though he did not have specimens from Gmelin's type locality, that this form must be known as *candida*,

<sup>33</sup> Nov. Zool., vol. 34, Aug., 1927, pp. 19-20.

this name antedating *pacifica* of Lesson of 1825. The name *candida* is here used in accordance with Hartert's suggestion.

These graceful little terns were common and were seen flying in pairs among the trees high up on the island, along the beaches, or over the sea. Mr. Cleaves took a number of photographs of them at the nesting place on Nuez Islet. They were common also at Wafer Bay.

**GYGIS MICRORHYNCHA Saunders**

Slender-billed fairy tern

*Gygis microrhyncha* SAUNDERS, Proc. Zool. Soc. London, 1876, p. 668. (Marquesas Islands.)

The five skins of this fine bird obtained in the Marquesas were collected as follows: Male and female, Hivaoa, September 11 and 13; female, Nukuhiva, September 25; and male and female, Eiao, September 27, 1929. Until recently it has been supposed that this distinct species, known only from the Marquesas, was found on Nukuhiva Island alone, but this proves not to be the case. There is considerable variation in size, as the following measurements indicate, but otherwise the birds appear similar:

Sex	Locality	Wing	Tail	Culmen	Tarsus
		<i>Mm.</i>	<i>Mm.</i>	<i>Mm.</i>	<i>Mm.</i>
Male.....	Hivaoa.....	206.5	73.6	35.5	11.5
Do.....	Eiao.....	222.0	90.2	38.0	11.5
Female.....	Hivaoa.....	224.0	80.7	-----	12.3
Do.....	Nukuhiva.....	215.0	76.2	37.0	11.4
Do.....	Eiao.....	216.0	76.4	35.7	12.5

This little tern was common in the various islands of the Marquesas, especially in the higher timbered reaches. At Uahuka they also frequented the coconut groves, flying both above and under the treetops.

**COLUMBA LIVIA Gmelin**

Rock pigeon

*Columba domestica*  $\beta$  *livia* GMELIN, Syst. Nat., vol. 1, pt. 2, 1789, p. 769. (South Europe.<sup>34</sup>)

A male was taken at Uahuka in the Marquesas September 21, 1929. The pigeon is also recorded by Murphy<sup>35</sup> as naturalized on this same island, which he calls Huahuna.

Flocks of this pigeon often were seen among the rocky cliffs in the interior of Uahuka, and at the little village of Omoa many fed along the beach or rested on the cliffs at each side of a narrow bay.

<sup>34</sup> Type locality designated by Hartert, Vög. pal. Faun., vol. 2, Aug., 1920, p. 1465.

<sup>35</sup> Amer. Mus. Nov., No. 115, May 29, 1924, p. 8.

## NESOPELIA GALAPAGOENSIS GALAPAGOENSIS (Gould)

## Galapagos dove

*Zenaida Galapagoensis* GOULD, Zool. Voy. Beagle, vol. 3, Birds, 1841, p. 115, pl. 46. (Galapagos Archipelago.)

Two specimens, an adult and an immature female, were taken at Tower Island June 14, 1929.

This dove was common or even abundant on most of the islands we visited. It was scarce on Chatham Island, and was not seen on Charles Island, its absence or scarcity at these points probably being due to cats or mongrel dogs, accompaniments of civilization that are potent factors in the extermination of desirable wild life.

The doves are very tame and are sure to congregate about an observer who is seated on the ground. Once when the senior author was reclining in the shade of a shrub, a dove alighted on his elevated knee, walked along his leg, and then mounted to the toe of his shoe, where it rested and preened itself.

## PTILINOPUS DUPETITHOUARSII DUPETITHOUARSII (Neboux)

## Marquesan dove

*Columba Du Petithouarsii* NEBOUX, Rev. Zool., 1840, p. 289. (Christina Island=Tahuata, Marquesas Islands.<sup>36</sup>)

Five skins of this dove were secured on Fatuhiva in the Marquesas September 14 and 17, 1929.

This dove, the native name of which is "cook-koo," was common at Fatuhiva and often was seen flying high in air. Practically all the specimens secured were taken from banyan trees, where the birds were feeding on the berries among the top branches. In such a place they were rather difficult to see, for after alighting they remained motionless except when they reached for an occasional berry and in so doing disturbed a leaf.

## PTILINOPUS DUPETITHOUARSII VIRIDIOR (Murphy)

## Nukuhiva dove

*Ptilopus dupetithouarsi viridior* MURPHY, Amer. Mus. Nov., No. 115, May 29, 1924, p. 4. (Nukuhiva, Marquesas Islands.)

Two of these doves were obtained on Uahuka September 21, and one on Nukuhiva September 26. This race is well marked, differing from typical *P. d. dupetithouarsii* as indicated in the original description, in being distinctly greener, with a narrower, less obvious orange border at the sides of the pileum.

At the time we were in the region, the banyan tree seemed to be the most important source of food of this dove, as it was with the race at Fatuhiva.

<sup>36</sup> See Murphy, R. C., Amer. Mus. Nov., No. 115, May 29, 1924, p. 3.

We saw a few doves at Hivaoa in the high reaches, but as hunting them had made them wary, none was secured.

**PTILINOPUS CORALENSIS** Peale

Tuamotuan dove

*Ptilinopus coralensis* PEALE, U. S. Expl. Exp., vol. 8, 1848, p. 100. (Carlshoff or Aratika Island, Tuamotu group.)

Five males, four adult and one immature, were taken on Toau Atoll October 3, 6, and 7, 1929. The young bird is fully grown but is still in juvenal dress.

At Toau this dove, the native name of which is "o-oh," was comparatively rare, and it took a good deal of hunting to secure the four specimens above mentioned. It was never seen flying, but usually sat in a thick-foliaged, large-leaved tree, where the hunters slowly stalked it, aided by its occasional *o-oh* notes. The little native boys with sharp eyes and keen ears materially assisted in locating the birds.

**COCCYZUS FERRUGINEUS** Gould

Cocos Island cuckoo

*Coccyzus ferrugineus* GOULD, Proc. Zool. Soc. London, 1843, p. 105. (Cocos Island.)

An adult male of this cuckoo was collected at Wafer Bay, Cocos Island, June 10, 1929, by A. K. Fisher. It is generally similar to two others of the same sex in the National Museum but has the under side of the rectrices paler, less decidedly black with less sharply defined boundaries between the light and dark areas. It measures as follows: Wing, 128.4; tail, 162.0; culmen from base, 26.2; tarsus, 28.8 mm.

During our entire stay at Cocos Island the note of the cuckoo was not heard, indicating that the bird was not common. Mr. Cleaves and Chief Engineer Christensen each saw one, and the specimen taken at Wafer Bay makes three in all that came under observation. The cuckoo at Wafer Bay was sitting silently, and had it not moved slightly, it would not have been detected.

**COCCYZUS MELACORYPHUS** Vieillot

Azara's cuckoo

*Coccyzus melacoryphus* VIEILLOT, Nouv. Dict. Hist. Nat., vol. 8, 1817, p. 271. (Paraguay.)

Two were secured at Postoffice Bay on Charles Island in the Galapagos July 9, 1929.

Cuckoos seem to be rare in the Galapagos Islands, but this may be only apparent, as they sit rather closely in clumps of thick

shrubby and do not flush easily. They were observed only on Charles and Albemarle Islands. The specimens taken back of Post-office Bay were in thick vegetation along a dry wash, and were secured when they happened to cross the open space. One or two cuckoos were seen at another part of Charles Island, and one flew from a thick clump of bushes on Albemarle and subsequently could not be found.

**ASIO GALAPAGOENSIS (Gould)**

Galapagos short-eared owl

*Otus (Brachyotus) galapagoensis* GOULD, Proc. Zool. Soc. London, 1837, p. 10. (Galapagos Islands.)

A female obtained on Tower Island in the Galapagos, June 15, 1929, has the following measurements: Wing, 285.0; tail, 145.8; culmen with cere, 30.0; tarsus, 48.7 mm.

This owl was seen on Tower, Daphne, and Albermarle Islands, and pellets, which were assumed to be from this bird as they contained rat remains, were found at other places. Like our North American species this owl is diurnal and was seen flying in broad daylight.

**COLLOCALIA OCISTA Oberholser**

Marquesan swiftlet

*Collocalia ocista* OBERHOLSER, Proc. Acad. Nat. Sci. Philadelphia, 1906, p. 184. (Nukuhiva, Marquesas Islands.)

A series of eight was obtained at Uahuka in the Marquesas Islands September 19, 20, 21, and 23, 1929. Measurements of specimens with the sex indicated are as follows: Male, wing, 120.4; tail, 58.7; culmen from base, 4.9; tarsus, 9.0 mm. Two females, wing, 110.7, 118.0; tail, 58.3, 58.7; culmen from base, 4.8, 5.2; tarsus, 10.0, 9.0 mm.

Two specimens were placed in alcohol for anatomical material.

This interesting swift was observed in Hivaoa, Uahuka, Nukuhiva, and Eiao. It also undoubtedly occurs on Fatuhiva but did not happen to come under observation there. Two were killed on Hivaoa, but could not be found in the thick undergrowth where they had fallen. If we had had such willing helpers as the keen-eyed little natives at Fatuhiva and the Tuamotu Islands, there is little doubt that the birds would have been located. The swifts were more general on Uahuka, in coconut groves, along the open hill-sides, over the tops of bare ridges, and across the faces of steep cliffs. In the crevices of the cliffs they presumably had their nests. Their flight was usually rapid, resembling that of our chimney swift, but at times when they found slow-going insects in the shade of coconut groves they were much slower and more bat-like in their flight.

On one of the trips which Mr. Cleaves made to the upper reaches of Cocos Island, he saw swallows and swifts flying over a broad, grassy open stretch of country. In the absence of specimens it is hard to conjecture to just what species these birds belonged. Some day when material is forthcoming this interesting problem will be solved.

**ERIBATES MAGNIROSTRIS (Gould)**

Galapagos flycatcher

*Myiobius magnirostris* GOULD, Zool. Voy. Beagle, vol. 3, Birds, July, 1839, p. 48, pl. 8. (Chatham Island, Galapagos Archipelago.)

Of the three skins obtained, one was collected on Indefatigable Island June 24, and two on Duncan Island June 26, 1929. This little flycatcher was first observed on Indefatigable Island and later at Duncan, Charles, Chatham, and Hood. In action it suggests the crested flycatcher, and in size appears as if one of the smaller flycatchers had assumed the dress of its larger relatives. The species is very tame and appears anxious to get a better understanding of the human who has entered its domain. On one occasion while the senior author was pointing with a short stick to a distant canyon, one of these little birds flew from a near-by branch and alighted on the stick, as though it desired to be in closer touch with the visitors.

**NESOTRICCUS RIDGWAYI Townsend**

Cocos Island flycatcher

*Nesotriccus Ridgwayi* TOWNSEND, Bull. Mus. Comp. Zool., vol. 27, 1895, p. 124, col. pl. (Cocos Island.)

Three skins taken at Wafer Bay, Cocos Island, June 10, 1929, by A. K. Fisher, include a male, a female, and one with sex not marked. The female is especially interesting, since Ridgway<sup>37</sup> in his review of North and Central American flycatchers in 1907 in discussing this insular species noted that the female was not known. The skin from the Pinchot expedition collection is generally similar to the male, but is slightly less yellowish below and is distinctly smaller.

The two skins with sex marked measure as follows:

Male, wing, 61.7; tail, 56.5; culmen from base, 16.9; tarsus, 21.0 mm.

Female, wing, 57.3; tail, 52.3; culmen from base, 15.3; tarsus, 20.5 mm.

At Cocos, frequent showers made precipitation all but continuous, and this, added to the thick, tangled undergrowth, made land bird collecting very difficult. On the last day, before leaving the island, considerable time was spent in the low ground in the vicinity of

<sup>37</sup> Ridgway, Birds North and Middle America, pt. 4, 1907, p. 483.

Wafer Bay. While watching some small birds in the treetops, supposed to be immature golden warblers, we noticed one with a broader bill and promptly collected it. Later, while we were squeaking to attract birds in low marsh land, a pair of these flycatchers appeared and joined some golden warblers and finches which were earlier arrivals. In action, as they passed from twig to branch, they were not different from the golden warbler. These three were the only ones seen, although considerable search was made for others.

**PYROCEPHALUS NANUS NANUS** Gould

Galapagos vermilion flycatcher

*Pyrocephalus nanus* GOULD, Zool. Voy. Beagle, pt. 3, Birds, July, 1839, p. 45, pl. 7. (Several Islands of Galapagos Archipelago.)

One male and three females were obtained on Indefatigable Island June 18, 20, and 24, and a male and a female on Charles Island June 27 and 28, 1929. The female from Charles Island is an immature bird with breast of deep buff lightly streaked, differing so decidedly from one of similar age from Indefatigable, which is pale yellow below, as to indicate that further study of *Pyrocephalus carolensis* Ridway<sup>38</sup> may show that that supposed form may be distinct, rather than a synonym of *P. nanus* as now considered. In view of the evident close relationship of the two recognized forms of *Pyrocephalus* from the Galapagos, it seems proper to consider them as subspecies rather than as distinct species.

This form of vermilion flycatcher was common on Indefatigable and Charles Islands, and a male was seen on Barrington. The females were very tame and on one occasion tried to alight on a gun that was being carried on the shoulder. The males were shyer and consequently less often seen. Persecution may account for this, since they are the only bright-colored birds on the island. The breeding season probably was over, for the males were silent, and were not seen to go through the wonderful aerial gyrations that form a regular mating manifestation in the Arizona form.

**PYROCEPHALUS NANUS DUBIUS** Gould

Pygmy vermilion flycatcher

*Pyrocephalus dubius* GOULD, Zool. Voy. Beagle, vol. 3, Birds, July, 1839, p. 46. (Chatham Island, Galapagos Archipelago.)

Three males and three females were secured on Chatham Island July 4 and August 20, 1929. These have the following measurements:

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<sup>38</sup> *Pyrocephalus carolensis* Ridgway, Proc. U. S. Nat. Mus., vol. 17, Nov. 15, 1894, p. 365. (Charles Island, Galapagos Archipelago.)



Males, wing, 57.9, 59.2, 57.0; tail, 50.0, 50.0, 49.8; culmen from base, 12.7, 11.4, 11.6; tarsus, 16.6, 17.2, 16.5 mm.

Females, wing, 57.3, 57.8, 56.1; tail, 50.5, 48.0, 46.9, culmen from base, 12.4, 11.6, 12.4; tarsus, 16.8, 17.5, 16.3 mm.

This form was common especially along the wide trail leading toward Progreso. It was found from sea level to the highest point.

**PROGNE MODESTA** Gould

Galapagos martin

*Progne modesta* GOULD, Zool. Voy. Beagle, pt. 3, Birds, July, 1839, p. 39, pl. 5. (James Island, Galapagos Archipelago.)

A pair was obtained at Eden Island, near Indefatigable, June 24, 1929.

Martins were seen almost daily when we went ashore on the more open and level stretches of Indefatigable and Seymour Islands. Unfortunately whenever they appeared the distance was too great or the time was inopportune to capture them. At Daphne Island, June 23, numbers were observed about the cliffs, where they nested in crevices in close association with Galapagos shearwaters, noddy terns, tropic-birds, and fork-tailed gulls. The following day Eden was visited and numbers were seen either entering or leaving their nesting crevices in the cliffs. Two specimens were secured as they flew over the boat.

**NESOMIMUS MELANOTIS DIERYTHRUS** Heller and Snodgrass

Indefatigable Island mocking bird

*Nesomimus melanotis dierythrus* HELLER and SNODGRASS, Condor, May, 1901, p. 74. (North Seymour Island, near Indefatigable, Galapagos Archipelago.)

Two males were obtained on Indefatigable Island June 19 and July 8, 1929.

**NESOMIMUS MELANOTIS BAURI** Ridgway

Tower Island mocking bird

*Nesomimus bauri* RIDGWAY, Proc. U. S. Nat. Mus., vol. 17, November 15, 1894, p. 357. (Tower Island, Galapagos Archipelago.)

Two males with spotted breasts of immature plumage were taken on Tower Island June 14, 1929.

**NESOMIMUS MELANOTIS BARRINGTONI** Rothschild

Barrington Island mocking bird

*Nesomimus barringtoni* ROTHSCHILD, Bull. Brit. Orn. Club, vol. 8, October 31, 1898, p. vii. (Barrington Island, Galapagos Archipelago.)

Male and female were taken on Barrington Island August 1, 1929.

**NESOMIMUS MELANOTIS PARVULUS (Gould)**

## Albemarle Island mocking bird

*Orpheus parvulus* GOULD, Proc. Zool. Soc. London, 1837, p. 27. (Galapagos Archipelago.)

A male was shot at Villamiel, August 22, and a female at Tagus Cove, August 25, on Albemarle Island. It seems preferable to call this bird a race of *melanotis* in view of its close resemblance to other forms placed there, rather than to consider it a specific entity as Rothschild and Hartert have done.<sup>39</sup>

**NESOMIMUS MACDONALDI Ridgway**

## Hood Island mocking bird

*Nesomimus macdonaldi* RIDGWAY, Proc. U. S. Nat. Mus., vol. 12, February 5, 1890, p. 103, fig. 1. (Hood Island, Galapagos Archipelago.)

Two males, one adult and one immature, were taken at Hood Island June 30, 1929. The adult bird is molting the rectrices. The immature individual has the breast distinctly spotted with dusky and the under tail-coverts buffy brown.

**NESOMIMUS ADAMSI Ridgway**

## Chatham Island mocking bird

*Nesomimus macdonaldi* RIDGWAY, Proc. U. S. Nat. Mus., vol. 12, February 5, 1894, p. 358. (Chatham Island, Galapagos Archipelago.)

An immature female with spotted breast, and an adult male, were taken at Chatham Island July 3 and 4, 1929, respectively.

On account of their similar habits the six subspecies taken on Tower, Indefatigable, Chatham, Hood, Barrington, and Albemarle Islands will be treated under one heading. As the Charles Island bird was reported as very rare, everyone who went ashore was requested to be on the lookout for it, but none was seen.

This mocker is a free and easy, rollicking, inquisitive, fearless clown, so it was thought appropriate to give him the nickname of "Jake" which was approved and accepted; thus all mockers thereafter were "Jakes." Almost as soon as we landed on any of the islands, some of these birds would meet us and would go over in detail any article that by chance was laid down for a moment. A gun for instance was examined carefully with attempt to run the bill into narrow crevices or the birds peered down into the mysterious darkness of the barrels. When their attention was attracted they had two ways of approach, either by flying direct and alighting on the nearest elevation, or wrenlike, by coming quietly through the undergrowth to appear suddenly at our side. Their song, the principal one heard,

<sup>39</sup> Nov. Zool., vol. 6, Aug., 1899, pp. 143, 146, 147.

was attractive, but to a possibly prejudiced mind did not seem equal to that of our mocking birds, brown thrashers, or catbirds.

These mockers feed ordinarily on fruit and berries and take the juicy parts of cactus pads for drink. Whenever mocking birds or finches see cactus pads being cut they immediately come to the spot and eagerly eat the watery pulp as soon as it is placed within reach. They also eat insects, especially grasshoppers, and we learned something of the food habits of the iguana when an individual rushed and secured a grasshopper that a mocking bird had accidentally dropped near it. Mockers always seemed ready to join in lunch, but not always willing to accept what was given them. Once on Chatham while the senior author was eating a guava and scattering the pieces of skin on the ground, seven mockers came and joined in the feast. On another occasion while he was eating lunch two mockers and five lizards formed in a broken circle and ate with relish bits of fruit jam thrown to them.

Although members of a family seem to get along well together the mocking bird is liable to be quarrelsome with outsiders and, if possible, will prevent them from entering its domain. Families of full-grown young, still with spotted breasts, were seen, but no fresh nests or eggs were observed.

**CONOPODERAS MENDANAE MENDANAE (Tristram)**

Hivaoa warbler

*Acrocephalus mendanac* TRISTRAM, Ibis, 1883, p. 43, pl. 1. (Marquesas Islands=Hivaoa or Tahuata Island.<sup>40</sup>)

Two males taken at Hivaoa, September 12, 1929, have the following measurements: Wing, 97.4, 96.8; tail, 85.8, 85.4; culmen from base, 28.7, 30.6; tarsus, 32.3, 30.8 mm.

Murphy<sup>40</sup> has listed the Marquesan warblers as subspecies of *Conopoderas caffra* of the Society Islands, a treatment with which the junior author does not agree. Though obviously of similar stock, the Marquesan forms all stand out as distinctly brighter yellow, maintaining this general appearance throughout their other variations from type so that they are distinguished at a glance. In view of this unity and of the separate groups of islands inhabited, it seems best to consider the two series of geographic races specifically distinct.

**CONOPODERAS MENDANAE PERCERNIS Wetmore**

Nukuhiva warbler

*Conopoderas percernis* WETMORE, Bull. Mus. Comp. Zool., vol. 63, August, 1919, p. 213. (Nukuhiva Island, Marquesas Islands.)

The two males and one female obtained were collected on Nukuhiva, September 25 and 26, 1929. They measure as follows: Males,

<sup>40</sup> See Murphy, Amer. Mus. Nov., No. 337, Dec. 13, 1928, p. 12.

wing, 95.5, 100.2; tail, 87.8, 90.2; culmen from base, 28.9, 29.2; tarsus, 32.9, 32.3 mm. Female, wing, 95.5; tail, 84.3; culmen from base, 28.0; tarsus, 30.6 mm.

This race differs from typical *mendanae* in brighter yellow of the under surface and of the light edgings of the feathers of the dorsal region.

CONOPODERAS MENDANAE IDAE Murphy

Uahuka warbler

*Conopoderas caffra idae* MURPHY, Amer. Mus. Nov., No. 337, December 13, 1928, p. 15. [Huahuna (Uahuka) Island, Marquesas Islands.]

Three males, two females, and one bird with sex not indicated were collected at Uahuka Island in the Marquesas September 19, 20, and 21, 1929. All are in fresh, bright plumage. Measurements are as follows:

Three males, wing, 87.2–89.3 (88.5); tail, 78.3–81.0 (79.6); culmen from base, 23.2–24.4 (23.7); tarsus, 29.3–31.8 (30.3) mm.

One female, wing, 80.5; tail, 73.6; culmen from base, 23.3; tarsus, 26.9 mm.

This form, in coloration, is much like *percernis* but is decidedly smaller.

CONOPODERAS MENDANAE FATUHIVAE Murphy

Fatuhiva warbler

*Conopoderas caffra fatuhivae* MURPHY, Amer. Mus. Nov., No. 337, December 13, 1928, p. 14. (Fatuhiva Island, Marquesas Islands.)

Six males and one female collected on Fatuhiva Island, September 14, 15, and 17, 1929, are all in excellent plumage. The series measures as follows:

Six males, wing, 92.5–99.7 (96.3); tail, 80.2–87.0 (84.4); culmen from base, 28.0–29.8 (29.1); tarsus, 31.5–34.2 (33.1) mm.

One female, wing, 91.8; tail, 82.0; culmen from base, 28.7; tarsus, 31.3 mm.

The present form is generally similar to *C. m. percernis* but has the rump much more extensively yellow, while the bill and tarsus are longer. The feet and tarsi are paler brown in the dried skin.

CONOPODERAS MENDANAE AQUILONIS Murphy

Eiao warbler

*Conopoderas caffra aquilonis* MURPHY, Amer. Mus. Nov., No. 337, December 13, 1928, p. 17. (Eiao Island, Marquesas Islands.)

Three males and one female obtained September 27 and 28, 1929, on Eiao Island in the Marquesas, have the following measurements:

Three males, wing, 89.7–92.4 (91.4); tail, 78.4–83.9 (81.3); culmen from base, 24.3–25.8 (25.1); tarsus, 28.3–30.2 (28.9) mm.



Photograph by H. H. Cleaves

COCONUT GROVE, HIVA OA ISLAND, MARQUESAS ISLANDS



Photograph by H. H. Cleaves

HIVA OA ISLAND, MARQUESAS ISLANDS



Photograph by H. H. Cleaves

A LOWLAND STREAM ON HIVA OA ISLAND, MARQUESAS ISLANDS



Photograph by H. H. Cleaves

TOAU, TUAMOTU ISLANDS

One female, wing, 89.0; tail, 80.7; culmen from base, 23.8; tarsus, 29.4 mm.

In the Marquesas Islands five forms of this interesting bird, each peculiar to the island it inhabits, were taken on Hivaoa, Fatuhiva, Uahuka, Nukuhiva, and Eiao.

Our first landing was at Hivaoa, and although collecting began early none of this species was seen on the first day. It is uncertain whether the fact that the imported mynah bird occurs only on this island had anything to do with the absence of the warbler. The following day we went back in a canyon to one of the upper coconut groves and soon were encouraged by hearing a fine song coming from the top of a coconut tree. After a good deal of effort two specimens were secured. When a bird has completed its song in one treetop it often flies to another, maybe 100 yards distant. Its regular flight between trees very closely suggests that of an oriole, and the size and yellowish color add to this resemblance.

The song is very attractive and so modulated that one thinks first of a thrush and then of a thrasher, but fails to detect at any time the flutelike cadence of the former bird. On some occasions several birds were heard singing at the same time. While singing, the birds are motionless and are so well hidden by the coconut foliage that it is next to impossible to see them from below. At some of the other islands, especially Fatuhiva and Uahuka, the birds were found in the villages among the coconut groves, and the natives referred to them when seen or heard as "comacco."

Uahuka was the only place where we saw young birds still more or less dependent on the parents. Here the old birds were seen feeding the young on food gleaned from among the coconuts.

#### CONOPODERAS ATYPHA ATYPHA Wetmore

##### Fakarava warbler

*Conopoderas atypa atypa* WETMORE, Bull. Mus. Comp. Zool., vol. 63, August, 1919, p. 206. (Fakarava Island, Tuamotu Islands.)

The series of nine obtained in the Tuamotu group includes two males and one female from Fakarava collected October 2, 1929, and three males, one female, and two with sex not indicated shot on Toau Atoll October 4, 1929. In view of the extended series of warblers from the Tuamotus examined by Murphy and Mathews<sup>41</sup> their decision is accepted that the typical form of *atypa* ranges through most of the northern and western islands of the Tuamotu group. The species is one in which there is considerable range in individual color variation, so that in examining the first specimens obtained, collected by the *Albatross* Expedition of 1899 and 1900 to the

<sup>41</sup> Amer. Mus. Nov., No. 350, May 7, 1929, pp. 6-12.

Tropical Pacific, the junior author was misled into attempting to distinguish additional races in this area.

In the present series from Fakarava two birds are rufescent and one gray. The six from Toau include three rufescent birds, two with yellowish cast, and one that is much paler, evidently inclining toward albinism. The habits of this warbler, the native name of which is "okeko keko," are very similar to that of the Marquesan bird, except that the song is not so general, nor of so long duration. This may be due to the fact that the breeding season was completed at an earlier date. The birds were seen more often in the lower shrubbery than among the coconut leaves, though some still remained much of the time in their favorite resorts. The young no longer were following their parents and it was the exception to see two together. Judging from their habit of creeping among the leaves, especially near the bases of the coconut trees, the species must secure considerable food from this source.

**POMAREA IPHIS IPHIS** Murphy

Huahuna flycatcher

*Pomarea iphis iphis* MURPHY, Amer. Mus. Nov., No. 337, December 13, 1928, p. 6. (Huahuna Island, Marquesas group.)

The six specimens obtained were collected on Uahuka Island (known also as Huahuna) in the Marquesas September 20 and 21, 1929. Among them is a juvenile bird only recently from the nest, still clothed in the fluffy first plumage. This bird is grayer on the crown and upper back and has the breast and sides dull gray, so that Murphy's statement <sup>42</sup> that "juvenals resemble adult females save for the absence of dark streaking on the throat" must refer to birds in postjuvénal dress.

A nest containing one small young secured September 20 is a cup-shaped structure with rather heavy walls and base placed in the fork of a mango tree 10 feet from the ground, where it was built about several small limbs so that it was firmly and strongly anchored. It is composed of slender brown plant fibers, some of which come from the coconut palm, a small amount of wild cotton down, and a few spider webs, with a few coarse black and brownish-black hairs in the lining. It is approximately 100 mm. long by 70 mm. high.

This species was found only on Uahuka. The first individual seen was at a distance sitting on a dead lower branch of a tree and in outline suggested a phoebe. This bird was followed and later its nest in a mango was found. It is probably a mere coincidence that all the birds seen or collected were in or near mango trees, which form a very small part of the wooded area. In action the Uahuka flycatcher is more like our flycatcher, and quite different

<sup>42</sup> Amer. Mus. Nov., No. 337, Dec. 13, 1928, p. 7.



from the *Fatuhiva* species, which rambles through the foliage much after the manner of our warblers.

**POMAREA WHITNEYI** Murphy

*Fatuhiva* flycatcher

*Pomarea whitneyi* MURPHY, Amer. Mus. Nov., No. 337, December 13, 1928, p. 8. (*Fatuhiva* Island, Marquesas Islands.)

A series of six secured September 14, 16, and 17, 1929, on *Fatuhiva* in the Marquesas include three adult and two immature males, and one female. One of the immature males has begun to molt into adult dress, black feathers appearing on head, throat, and breast.

This species was seen only on *Fatuhiva*, usually in the thick undergrowth. It was very active and continually on the move, which made it more different of approach.

**ACRIDOTHERES TRISTIS TRISTIS** (Linnaeus)

Indian mynah

*Paradisca tristis* LINNAEUS, Syst. Nat., ed. 12, vol. 1, 1766, p. 167. (Philippines=Calcutta.<sup>43</sup>)

Two females of this introduced species were taken on *Hivaoa* Island in the Marquesas group September 11 and 12, 1929. These seem similar to typical specimens from its proper home in India and are identified as the typical subspecies. They have the following measurements: Wing, 138.2, 136.1; tail, 80.4, 83.1; culmen from base 22.2, 22.0; tarsus, 38.2, 37.5 mm.

Mynah birds were seen only at *Hivaoa*, Marquesas Islands, and at Tahiti, Society Islands. In both places they were common, and in their habitat few other birds were observed.

**DENDROICA PETECHIA AUREOLA** (Gould)

Galapagos golden warbler

*Sylvicola aureola* GOULD, Zool. Voy. Beagle, pt. 3, Birds, Nov., 1839, p. 86, pl. 28. (Galapagos Islands.)

On Cocos Island, A. K. Fisher secured a series of ten, June 5, 6, 9, and 10, 1929, including adults of both sexes and a number of young. The latter range from juveniles with the underparts nearly pure white to others in various stages of molt into the post-juvenal dress. Comparison of these birds in all stages bears out previous statements that the golden warbler found on Cocos Island is identical with that ranging through the Galapagos Archipelago.

Measurements of four adults from Cocos Island follow:

Two males, wing, 65.3–65.9; tail, 50.8–53.3; culmen from base, 12.4–13.3; tarsus, 19.3–21.0 mm.

<sup>43</sup> Baker, E. C. Stuart, Faun. Brit. India, Birds, ed. 2, vol. 3, March, 1926, p. 53.

Two females, wing, 60.0–61.7; tail, 48.3–51.3; culmen from base, 12.8–12.9; tarsus, 19.7–19.8 mm.

In the Galapagos an immature female was taken on Tower Island June 15, and adult males on Indefatigable June 19, and at Villamiel on Albemarle Island August 22.

On Cocos Island the golden warbler was the commonest species among land birds, with the possible exception of the finch. No young were seen that were still dependent on the parents, but those in recently acquired post-juvenal plumage were much in evidence. The species was fairly common in the Galapagos Islands, and on Chatham and Charles the many advancing stages of the immature plumage were noted.

This and the vermilion flycatcher were the two bright-colored birds of the Galapagos group. The adult males seemed more or less quarrelsome, and anxious to drive the others out of the neighborhood.

**CERTHIDEA CINERASCENS CINERASCENS Ridgway**

Gray certhidea

*Certhidea cinerascens* RIDGWAY, Proc. U. S. Nat. Mus., vol. 12, February 5, 1890, p. 105. (Hood Island, Galapagos Archipelago.)

Two males and a female were secured on Hood Island June 30, 1929. These specimens are in partial molt.

Though currently referred to the family of wood warblers<sup>44</sup> this genus seems better placed in the Fringillidae.<sup>45</sup>

**CERTHIDEA CINERASCENS BIFASCIATA Ridgway**

Barrington Island certhidea

*Certhidea bifasciata* RIDGWAY, Proc. U. S. Nat. Mus., vol. 17, November 15, 1894, p. 359. (Barrington Island, Galapagos Archipelago.)

Male and female collected on Barrington Island August 1, 1929, have the following measurements:

Male, wing, 52.0; tail, 37.3; culmen from base, 10.8; tarsus, 19.8 mm.

Female, wing, 51.0; tail, 37.7; culmen from base, 10.7; tarsus, 19.5 mm.

**CERTHIDEA OLIVACEA OLIVACEA Gould**

Darwin's certhidea

*Certhidea olivacea* GOULD, Proc. Zool. Soc. London, 1837, p. 7. (Galapagos Archipelago.)

A female taken on Indefatigable Island has the following measurements: Wing, 52.7; tail, 36.3; culmen from base, 9.7; tarsus, 21.3 mm.

<sup>44</sup> See Lucas, Proc. U. S. Nat. Mus., vol. 17, 1894, pp. 309, 310; and Ridgway, U. S. Nat. Mus. Bull. 50, pt. 2, 1903, p. 762.

<sup>45</sup> See Swarth, Proc. California Acad. Sci., vol. 18, Jan. 29, 1929, pp. 36–41.

**CERTHIDEA OLIVACEA LUTEOLA** Ridgway

## Chatham Island certhidea

*Certhidea luteola* RIDGWAY, Proc. U. S. Nat. Mus., vol. 17, November 15, 1894, p. 360. (Chatham Island, Galapagos Archipelago.)

Three specimens were obtained on Chatham Island, two adults on July 3, and a bird in juvenal dress on July 4, 1929.

**CERTHIDEA OLIVACEA MENTALIS** Ridgway

## Tower Island certhidea

*Certhidea mentalis* RIDGWAY, Proc. U. S. Nat. Mus., vol. 17, November 15, 1894, p. 359. (Tower Island, Galapagos Archipelago.)

A female was secured at Tower Island, June 14, 1929.

*Certhidea* is another of those plastic genera that can not resist those all-powerful but mysterious forces that bring changes caused by environment. On Indefatigable, Chatham, Tower, Hood, and Barrington Islands we found forms specifically or subspecifically different, but the same so far as habits go. The bird was looked for carefully on Charles Island, but without success.

It was a confiding little bird, and seemed anxious to be as near the observer as possible. In its movements it reminded one much of a pine siskin. They often were in mixed flocks with ground finches and all seemed in perfect harmony with one another, quite in contrast with the mockers and golden warblers. They usually keep in low shrubbery and are rarely found in the trees.

**PINAROLOXIAS INORNATA** (Gould)

## Cocos Island finch

*Cactornis inornatus* GOULD, Proc. Zool. Soc. London, 1843, p. 104. (Bow Island=Cocos Island.)

Eight skins and two skeletons secured on Cocos Island June 4, 7, and 10, 1929, by A. K. Fisher include four males and six females. As few measurements have been published the following will be of interest:

Four males, wing, 64.4–67.3 (65.8); tail, 40.7–41.2 (40.9); culmen from base, 14.1–14.7 (14.4); tarsus, 21.2–21.7 (21.3) mm.

Six females, wing, 61.3–65.2 (62.9); tail, 39.5–43.6 (41.3); culmen from base, 12.8–14.3 (13.4); tarsus, 20.0–22.3 (21.2) mm.

The fully adult female has the bill blackish, while in immatures of that sex the bill is yellowish brown, more or less obscured by dusky at base in tip. The immature female in addition has the rectrices prominently tipped with brown.

The general movements and actions of this little bird were more like those of a honey creeper than any other finch that has come

under observation. It is a bird of the deep woods and was rarely seen in the more open country unless lured there by squeaking notes. Usually they were found grouped in little families. Dr. J. B. Mathewson found a rounded nest which contained two unfledged young in the top of a sapling about 15 feet from the ground. The parent bird looked on while the doctor was examining the nest but did not show any anxiety. This finch was the most common of the land birds, with the possible exception of the golden warbler.

**GEOSPIZA FATIGATA** Ridgway

Indefatigable cactus finch

*Geospiza fatigata* RIDGWAY, Proc. U. S. Nat. Mus., vol. 18, April 23, 1896, p. 293. (Indefatigable Island, Galapagos Archipelago.)

Eight skins of this form include three from Indefatigable taken June 18 and 24, and five from Barrington Island August 1, 1929. Adults from the latter locality are in partial molt. Following are measurements:

Sex and locality	Wing	Tail	Culmen from base	Depth of bill	Tarsus
Male:	<i>Mm.</i>	<i>Mm.</i>	<i>Mm.</i>	<i>Mm.</i>	<i>Mm.</i>
Indefatigable Island.....	70.2	43.9	19.5	9.8	21.3
Barrington Island.....	71.1	45.6	21.1	10.5	22.3
Do.....	71.5	44.0	19.3	10.8	23.1
Do.....	69.2	41.4	19.5	10.5	22.3
Female:					
Indefatigable Island.....	69.3	45.8	19.1	9.5	22.6
Barrington Island.....	70.7	44.0	20.2	11.2	22.5
Do.....	69.0	40.9	17.8	10.7	22.3

**GEOSPIZA ACUTIROSTRIS** Ridgway

Sharp-billed ground finch

*Geospiza acutirostris* RIDGWAY, Proc. U. S. Nat. Mus., vol. 17, November 15, 1894, p. 363. (Tower Island, Galapagos Archipelago.)

One immature and two adult males were taken on Tower Island June 15 and 16, 1929, the adults having the bill black. Following are measurements from the old birds: Wing, 60.2, 60.5; tail, 36.8, 39.6; culmen from base, 13.2, 13.5; tarsus, 19.5, 18.5 mm.

**GEOSPIZA FULIGINOSA** Gould

Sooty ground finch

*Geospiza fuliginosa* GOULD, Proc. Zool. Soc. London, October 3, 1837, p. 5. (Chatham Island, Galapagos Archipelago.)

The present species is apparently one of the abundant species of its genus, since it is represented in the collection by 25 skins from

Albemarle, Chatham, Hood, Barrington, Charles, Duncan, and Indefatigable Islands. The series is quite uniform in structural characters with the usual variations in plumage markings due to relative age. Some of the males in full black dress have the bills pale-colored and in some they are black.

**GEOSPIZA FORTIS** Gould

Sturdy ground finch

*Geospiza fortis* GOULD, Proc. Zool. Soc. London, October 3, 1837, p. 5. (Galapagos Islands.)

One adult male of this form was collected on Seymour Island, near Indefatigable, June 21, 1929, and two, an immature male and a female, on Charles Island June 28. The adult male from Seymour has the following measurements: Wing, 71.8; tail, 42.7; culmen from base, 17.1; depth of bill, 12.7; tarsus, 22.8 mm. The female from Charles Island measures: Wing, 70.0; tail, 43.8; culmen from base, 17.0; depth of bill, 11.9; tarsus, 22.0 mm.

**GEOSPIZA ALBEMARLEI** Ridgway

Albemarle ground finch

*Geospiza albemarleii* RIDGWAY, Proc. U. S. Nat. Mus., vol. 17, November 15, 1894, p. 362. (Tagus Cove, Albemarle Island, Galapagos Archipelago.)

The series of eight skins of this species, including one immature and three adult males and four females, was obtained on Albemarle Island August 22 and 25, those taken on the 22d coming from Villamiel. The adult males have the bill black with a slight wash of brown on the gonys.

The following measurements were taken from this series:

Males, wing, 73.2, 76.0, 73.8; tail, 41.0, 46.3, 44.5; culmen from base, 18.0, 17.5, 18.7; tarsus, 23.0, 22.9, 22.5 mm.

Females, wing, 71.4, 73.2, 70.3, 67.3; tail, 44.0, 47.4, 45.3, 40.5; culmen from base, 15.3, 17.9, 17.8, 16.1; tarsus, 22.0, 21.7, 22.2, 21.6 mm.

**GEOSPIZA DUBIA** Gould

Dubious ground finch

*Geospiza dubia* GOULD, Proc. Zool. Soc. London, October 3, 1837, p. 6. (Galapagos Islands.)

A pair of these finches came from Chatham Island, collected July 4, 1929. They measure as follows:

Male, wing, 73.0; tail in molt; culmen from base, 18.2; depth of bill, 15.0; tarsus, 23.3 mm. Female, wing, 68.6; tail, 45.1, culmen from base, 17.3; depth of bill, 14.0; tarsus, 22.8 mm.

**GEOSPIZA PROPINQUA** Ridgway

## Tower Island ground finch

*Geospiza propinqua* RIDGWAY, Proc. U. S. Nat. Mus., vol. 17, November 15, 1894, p. 361. (Tower Island, Galapagos Archipelago.)

Four were obtained on Tower Island June 14 and 16, 1929, including adult and immature males, and two females. The adult male has the bill black except for a brownish wash along the gonys. In the immature male it is brown. One of the females is very black with the light markings much restricted. The other, with the light markings predominating below, is apparently a juvenile individual.

These skins have the following measurements:

Male, wing, 76.4, 72.5; tail, 47.5, 43.8; culmen from base, 18.6, 19.5; depth of bill, 11.4, 10.9; tarsus, 24.6, 24.5 mm.

Females, wing, 70.5, 68.9; tail, 42.0, 42.0; culmen from base, 19.3, 18.0; depth of bill, 12.7, 11.8; tarsus, 24.7, 22.5 mm.

**GEOSPIZA CONIROSTRIS** Ridgway

## Conical-billed ground finch

*Geospiza conirostris* RIDGWAY, Proc. U. S. Nat. Mus., vol. 12, February 5, 1890, p. 106, fig. 2. (Hood Island, Galapagos Archipelago.)

Six skins taken on Hood Island June 30 and July 1, 1929, include one adult male and five females. The male has the bill black with a slight wash of brown on the gonys. The females are very dark, with the light margins of the feathers much restricted. Measurements are as follows:

Male, wing, 81.8; tail, 45.0; culmen from base, 20.8; depth of bill, 15.2; tarsus, 23.2 mm.

Females, wing, 73.3, 72.2, 72.6, 76.3, 74.5; tail, 43.6, 44.0, 44.0, 46.2, 44.0, culmen from base, 19.2, 19.4, 20.5, 20.2, 20.5; depth of bill, 14.7, 13.6, 16.2, 15.0, 14.5; tarsus, 21.7, 22.0, 23.0, 23.0, 23.0 mm.

**GEOSPIZA PACHYRHYNCHA** Ridgway

## Thick-billed ground finch

*Geospiza pachyrhyncha* RIDGWAY, Proc. U. S. Nat. Mus., vol. 18, April 23, 1896, p. 293. (Tower Island, Galapagos Archipelago.)

Two females of this heavy-billed form were collected on Tower Island June 16, 1929, one being considerably darker than the other with the sides of the mandible largely black. Measurements are as follows: Wing, 82.0, 78.8; tail, 49.5, 46.7; culmen from base, 22.1, 23.7; depth of bill, 20.0, 21.8; tarsus, 25.8, 24.2 mm.

## GEOSPIZA STRENUA Gould

## Gould's ground finch

*Geospiza strenua* GOULD, Proc. Zool. Soc. London, October 3, 1837, p. 5. (Galapagos Archipelago.)

A female was secured on Indefatigable June 18, 1929, an adult male at Academy Bay on the same island July 8, and a pair at Villamiel, Albemarle Island, August 22. Of the latter the male is immature, being in the dress of the female with light-colored bill. The bill in the adult from Indefatigable is black. Measurements are as follows:

Sex and locality	Wing	Tail	Culmen from base	Depth of bill	Tarsus
Male:	<i>Mm.</i>	<i>Mm.</i>	<i>Mm.</i>	<i>Mm.</i>	<i>Mm.</i>
Indefatigable Island.....	80.1	50.3	22.6	19.0	26.3
Albemarle Island.....	74.8	45.1	20.3	17.0	23.8
Female:					
Indefatigable Island.....	77.0	49.8	19.5	15.8	23.6
Albemarle Island.....	75.0	47.3	21.9	19.4	25.2

Treatment of the forms of *Geospiza* in the present collection follows that of Ridgway in part 1 of Bulletin 50 of the United States National Museum, all specimens being determined in accordance with characters there given. No attempt is made to use trinomials, though it is plainly evident that some of the forms are related sub-specifically on adjacent islands, the problem of such relationship being so complicated as to be successfully studied only with a complete representation in series of the various forms.

In a recent paper, H. S. Swarth<sup>46</sup> has erected a separate family, the Geospizidae, for the genera *Geospiza*, *Pinaroloxias*, *Camarhynchus*, *Platyspiza*, and *Certhidea*. After due consideration of the alleged characters we are unable to find trenchant grounds for separating these from the Fringillidae. The close association of the genera listed is evident, but it is doubtful if they have sufficient difference as a group to merit even subfamily designation.

So far as habits go we shall have to consider the 10 species of Galapagos ground finches that came under observation as one form. Unfortunately Wenman and Culpepper Islands, rich in bird life, were not visited; if they had been, several additional species would undoubtedly have been observed.

These finches go in mixed flocks, and feed together just as if they were the same species. Fully one hundred have been seen in one of these masses. On two occasions a number were seen to congre-

<sup>46</sup> Proc. California Acad. Sci., vol. 18, Jan. 29, 1929, pp. 30-31.

gate about a certain spot and go down in the crevices among lava rock one or two at a time. It was learned that they went after water, but the question is how they knew it was there. They feed on berries and small fruit and are especially fond of the pricklypear of the cactus. They also get fluid by picking into the cactus pads. Large numbers of their old nests were found but no fresh ones were located.

**CAMARHYNCHUS PROSTHEMELAS** Sclater and Salvin

Black-headed ground finch

*Camarhynchus prothemelas* SCLATER and SALVIN, Proc. Zool. Soc. London, November, 1870, p. 325, fig. 4. (Indefatigable Island, Galapagos Archipelago.)

Two females and one juvenile bird with sex not marked were collected on Charles Island June 27, 1929. The young bird, which is fully grown, differs from the adults principally in being somewhat browner. The females have the following measurements: Wing, 60.0, 60.2; tail, 37.3, 37.5; culmen from base, 10.0, 9.4; tarsus, 21.5, 21.5 mm.

**PLATYSPIZA CRASSIROSTRIS** (Gould)

Darwin's ground finch

*Camarhynchus crassirostris* GOULD, Proc. Zool. Soc. London, October 3, 1837, p. 6. (Galapagos Islands.)

Four skins of this species include two females and one with sex not marked from Chatham Island taken July 3 and 4, and August 20, and a male from Academy Bay, Indefatigable Island, July 8, 1929.

Measurements of these birds are as follows:

Sex and locality	Wing	Tail	Culmen from base	Tarsus
	<i>Mm.</i>	<i>Mm.</i>	<i>Mm.</i>	<i>Mm.</i>
Male, Indefatigable Island.....	85.4	57.1	16.3	29.5
Female, Chatham Island.....	81.5	54.7	17.2	27.7
Do. ....	81.7	51.0	16.0	27.4

In habits all the ground finches were very much alike, but under observation *Platyspiza* seemed to be more arboreal and to feed largely on the ovaries and minor parts of flowers, bringing to mind the purple finch. Those collected were taken while feeding on the soft parts of flowers of cotton and agave.

They appeared to be far less numerous than *Geospiza*.



# THE TWO-WINGED FLIES BELONGING TO SIPHOSTURMIA AND ALLIED GENERA, WITH DESCRIPTIONS OF TWO NEW SPECIES

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In the preparation of this paper I have examined all the type species concerned in the United States National Museum. I am greatly indebted to Dr. J. M. Aldrich, associate curator of the Division of Insects, not only for this privilege, but also for his encouragement and liberality in permitting the use of unpublished notes on the type of *Masicera normula* van der Wulp.

The muscoid tribe Siphosturmiini includes three known genera and seven species, of which two species are herein described as new. The peculiar or distinguishing characters of the group as a whole are: Face very flat with the front edge of the mouth protuberant; palpi normal in size, bowed upward near the apex; ocellars present; proboscis at least moderately slender and closely approximating or exceeding the height of head. The genus *Masiphya* exhibits about the same combination of characters, but the palpi are noticeably smaller and the genitalia are of a different type. Very little is known concerning the habits and biology of the siphosturmine flies. According to Coquillett's host list, two species, *rostrata* and *phycidis*, are parasites of lepidopterous larvae. Throughout the group the ovipositor is apparently subchitinous but blunt-tipped and not adapted for piercing.

The genera here considered may be separated by the characters mentioned in the following key:

## KEY TO GENERA OF SIPHOSTURMIINI

1. First vein of wing bare; second antennal joint one-half or more the length of third; vibrissae far above the lower margin of head.....2
- First vein setulose near base; second antennal joint one-fourth the length of third; vibrissae close to the lower margin of head.....*Microsillus* Aldrich

2. Proboscis distinctly exceeding the height of head, the apical joint very slender, tapering from base to tip; labella leathery, hardly wider than proboscis.....*Siphosturmia* Coquillett
- Proboscis not longer than the height of head, the apical joint moderately stout and uniform in thickness from base to tip; labella soft or fleshy and distinctly wider than proboscis.....*Siphosturmiopsis* Townsend

### Genus *MICROSILLUS* Aldrich

*Microsillus* ALDRICH, Proc. U. S. Nat. Mus., vol. 69, art. 22, p. 20, 1926. Female only; type, *Houghia baccharis* REINHARD.

The description of *H. baccharis*<sup>1</sup> was based on a single female specimen from Texas, and hitherto the male has been unknown. The accumulation of four additional specimens, including the male sex, makes it possible to add a number of essential items. The genus was described in the form of a comparison with *Siphosturmia* to which it is related. The resemblance, however, is confined largely to the female, and the male shows a number of striking and important differences. With these discoveries it appears desirable to redescribe the genus fully and to amend the specific characterization of the type species from the additional material now at hand.

*Generic characters* (from the type species).—Face in profile very flat and concave below, with the mouth jutting forward between the vibrissae; the latter on level with oral margin. Occiput on lower part bulging backward, so that the lower edge of the head is long, rather straight, and about equal to the axis at antennae. Proboscis when fully extended not much exceeding the height of head; palpi present. Front rather broad in both sexes, with orbitals, ocellars, and both pairs of verticals well developed. Frontals about six, diverging toward the eye below antennae, the uppermost two in each row rather stout and reclinate. Antennae in both sexes almost reaching the oral margin, second joint about one-fourth the length of third; arista hardly as long as antennae, penultimate joint only slightly longer than wide. Sides of face narrowed below, bare. Cheeks flattened, about one-fourth the eye height. Eyes bare.

Thoracic chaetotaxy: Acrostichal, 3, 3; dorsocentral, 3, 4; humeral, 4; posthumeral, 2; presutural, 2; notopleural, 2; intraalar, 3; supraalar, 3; postalar, 2; pteropleural, 1 (small); sternopleural, 2, 2; scutellum with one discal, three lateral, and a smaller decussate apical pair. Postscutellum normal; postnotum at side beneath calypter bare.

Abdomen varying with sex, in female the fourth segment somewhat elongate, noticeably deflexed, and tapering to a rather sharp

<sup>1</sup> Ann. Ent. Soc. Amer., vol. 14, p. 332, figs. 5, 6, 1921.

tip; ordinary in male. No discals on intermediate segments and without a marginal row on fourth in female. Venation of wings normal, first and third veins setulose near base; first posterior cell open well before apex of wing; no costal spine. Claws and pulvilli minute in both sexes.

MICROSILLUS BACCHARIS Reinhard

*Houghia baccharis* REINHARD, Ann. Ent. Soc. Amer., vol. 14, p. 332, figs. 5, 6, 1921.

*Male*.—Front at vertex 0.375 of head width in the one specimen, hardly widening downward; parafrontals gray pollinose with a yellow tinge, the latter becoming more pronounced toward the vertex extending on the upper part of the occiput and posterior orbits; elsewhere on head the pollen is wholly whitish, almost silvery; median stripe uniform in width to triangle, distinctly narrower than one parafrontal, reddish-brown; inner verticals long, directed backward, the outer ones about three-fourths as large, diverging posteriorly; ocellars and orbitals of equal size, proclinate; lowermost frontal at middle of parafacial on level with apex of second antennal joint, only the two pairs immediately above antennae decussate; facial ridges hardly higher than middle of face, bare except a few hairs next to vibrissae; the latter of good size and situated near edge of mouth; basal joints of antennae yellow, third black, four times length of second and fully twice width of parafacial below; arista of normal length, thickened to middle, black, basal joints distinct but not elongate; proboscis rather slender, labella apparently fleshy but rather small; palpi yellow, not much thickened apically, bowed upward; cheeks sparsely covered with short hairs; occipital fringe rather long on either side of vertex; beard moderately long, wholly pale or whitish.

Thorax gray pollinose, mesonotum when viewed from behind with an apparent yellowish tinge and showing four black stripes; the outer ones triangular in front, constricted and slightly interrupted at suture widening behind, thence tapering and stopping shortly in front of postalar callus; the inner pair narrow, complete at suture, extending about halfway to base of scutellum; pleura and humeri cinereous; scutellum reddish on apical half, disk with changeable gray pollen, entirely covered with short erect hairs; calypters opaque, white.

Abdomen black in ground color, the sides and narrow apex reddish; first segment black, the three following broadly gray pollinose with the hind margins shining in certain lights and subpollinose in a flat rear view except on fourth; venter reddish, with gray pollen on first three segments; first and second segments with one pair of median marginals (small on first); third with a marginal row of

10 or 12, stout; fourth with a row of discals and longer marginals, the latter situated well before the hind border of segment; genital segments small, retracted, reddish.

Legs black; mid tibia with two or more bristles on outer front side near middle; hind tibia with an irregular row on outer hind side; claws and pulvilli very small.

Wings faintly brownish; fourth vein with an abrupt stumpless bend, arcuate beyond and reaching costa far before wing tip; first posterior cell open; hind crossvein oblique to fourth, which it joins nearer to bend than to small crossvein; first vein setulose near base, the third more than halfway to small crossvein; costal spine vestigial.

*Female*.—This sex has been characterized (loc. cit.), but the three additional specimens show some variations that should be mentioned. Front at vertex 0.37, 0.35, and 0.38 of head width; parafrontals only faintly yellow in one, distinctly so in the other two, which have the region of the vertex almost golden. Very similar to male otherwise, but with the third antennal joint narrower; the intermediate abdominal segments shining black on posterior third; fourth segment wholly yellow, longer, more pointed, bearing an arcuate row of rather short spiny discals, with numerous weaker bristles behind which become almost hairlike at the apex. First genital segment tubular with a groove on either side behind, pale yellow; apical segment shining brownish, retracted, flattened behind and sloping forward to tip, not fitted for piercing.

Length, 7 mm. to 8.5 mm.

Redescribed from one male and four females, including type, from College Station, Tex., April, 1924 and 1929, and May 4, 1930 (H. J. Reinhard). The type specimen (female) is in the United States National Museum collection, which also contains a second specimen of the same sex from Ancon, Canal Zone, April 20, 1926 (C. T. Greene).

#### MICROSILLUS POLLINOSUS Townsend

*Siphosturmia* sp. TOWNSEND, ANN. ENT. SOC. AMER., vol. 4, p. 135, 1911.

*Siphosturmia pollinosa* TOWNSEND, PROC. U. S. NAT. MUS., vol. 43, p. 321, 1912.

I have seen the type series, including one male and four females from Peru, in the United States National Museum collection. The male has short claws and pulvilli, orbital bristles, and the same uncommonly wide front as in *H. baccharis*. Aldrich,<sup>2</sup> in comparing the present species with the single type specimen of *baccharis*, considered them distinct but expressed some doubt in the absence of sufficient material of the latter species for study. There are now

<sup>2</sup>Proc. U. S. Nat. Mus., vol. 69, art. 22, p. 20, 1926.

four specimens of *baccharis*, including both sexes, in my collection, besides the type female and one additional specimen, also a female, in the National Museum.

*M. pollinosus* differs from *H. baccharis*, the genotype, in having the last three abdominal segments covered with dull thick brassy-gray pollen, which on the intermediate segments extends nearly to the hind border, leaving only a very narrow blackish margin behind; cheeks and face grayish-white pollinose; parafrontals only faintly tinged with yellow. There appear to be no structural differences, except the apical joint of the proboscis in male is noticeably longer and the first abdominal segment has no median marginal bristles.

### Genus SIPHOSTURMIA Coquillett

*Siphosturmia* COQUILLETT, Revis. Tachin., p. 83, 1897.

Coquillett erected the genus *Siphosturmia* with *Argyrophylax rostrata* Coquillett as the type and sole species. He did not give any description of the generic characters other than stating that the principal ones were mentioned in his accompanying analytical key.

I have examined the type specimens now in the United States National Museum and give a brief description of the genus as follows:

*Generic characters* (from the type species).—Proboscis very slender, tapering apically, and distinctly exceeding the height of head; palpi present. Eyes bare. Front rather broad in both sexes; male without orbitals, female with two pairs; ocellars present, proclinate; the two uppermost frontal bristles reclinate, lower ones divergent, extending to level of apex of second antennal joint. Antennae inserted slightly above middle of eye, the second joint three-fourths the length of third; arista shorter than antennae, penultimate joint more than twice as long as wide. Face flat and projecting below, its lateral ridges also flattened and bearing only a few bristles above vibrissae, which are distinctly above the lower margin of head; parafacials bare. Oral cavity elongated by the head bulging behind so that the proboscis may be completely folded within.

Thoracic chaetotaxy: Humeral, 4; posthumeral, 3 (anterior one small); presutural, 2; notopleural, 2; sternopleural, 2, 2; pteropleural, 1 (small); acrostichal, 3, 3; dorsocentral, 3, 4; intraalar, 3; supraalar, 3; postalar, 2; scutellum with three lateral, one smaller decussate apical, and one discal pair. Postscutellum well developed; no infrascapular hairs present.

Abdomen without discal bristles on intermediate segments; one pair of median marginals on first and second segments; third with a marginal row of about eight; fourth segment in female noticeably deflexed, rather long and pointed, bearing numerous spiny bristles

on upper surface; in male the fourth segment is shorter than the third, ordinary in shape, with several irregular rows of bristles on apical half. Ovipositor blunt, not fitted for piercing.

Hind tibia ciliate. Wing with a rectangular bend in fourth vein, which ends far before the apex; veins bare except third; no costal spine.

**SIPHOSTURMIA ROSTRATA** Coquillett

*Argyrophylax rostrata* COQUILLETT, Journ. New York Ent. Soc., vol. 3, p. 106, 1895.

*Siphosturmia rostrata* COQUILLETT, Revis. Tachin., p. 83, 1897.

The long tapering proboscis, projecting mouth, and elongated second antennal joint make the species easily recognizable. It is a well-known form, and Coquillett's description supplies most of the essential specific details. In the male genitalia the inner forceps are blackish, narrow, and united at base, divided beyond middle but not divergent, tips blunt, in profile rather straight on posterior side and almost uniform in thickness from base to tip; outer forceps yellow, triangular, hardly shorter than inner, tips rounded, beset with minute black hairs; basal segment of penis slender, shining black, the distal one shorter and a little thickened, the apex with a pale expanding membrane.

The species ranges from Ohio to Florida and westward to Texas.

**SIPHOSTURMIA CONFUSA**, new species

Coquillett determined the present species as *Sturmia normula* van der Wulp, and although clearly misplaced in this genus, it has been passing under this name for many years. In 1929, Dr. J. M. Aldrich examined Wulp's type series now in the British Museum and kindly permitted me to study his notes. In brief these show that Wulp had two species involved, one of which is *Sturmia albifrons*, and the other, to be taken as the true *S. normula*, is a form closely allied to *S. albifrons*. A comparison of the species here considered with *albifrons* readily shows them to be distinct and members of different tribes.

*Male*.—Front at narrowest point (before ocelli) 0.34 of the head width (average of six: 0.32, 0.34, 0.34, 0.33, 0.36, 0.35); front and face covered with thick, rather dull-gray pollen; parafrontal clothed with black hairs, some extending close to eye; median stripe reddish, broad to triangle extending on either side to vertex; frontals about nine in number, uppermost two largest, reclinate, the lower one close to eye at level with base of third antennal joint; inner verticals strong, suberect, and curving backward, the outer pair usually vestigial but sometimes developed to half the size of inner ones and strongly divaricate; ocellars large, proclinate; no orbitals; para-

facial bare, at narrowest about as wide as third antennal joint; face not much receding, rather shallow or flat, with the lower edge moderately protruberant, the ridges bare except a few bristly hairs next to vibrissae; the latter somewhat approximated and situated near the oral margin; antennae fully three-fourths the length of face, third joint black, two and one-half to three times as long as second, basal joints faintly reddish; arista shorter than antennae, thickened on proximal two-fifths, penultimate joint at least twice as long as wide; cheek in profile one-sixth the eye height, gray pollinose on red ground color, bearing numerous fine black hairs; proboscis moderately slender, about equal the height of head; palpi yellow, slender, the tips bowed upward bearing a few black hairs beneath; posterior surface of head bulging backward at middle below, wholly gray pollinose and clothed with pale hairs; eyes practically bare.

Thorax gray pollinose, dorsum with four shining black stripes in front and five behind suture; scutellum broadly reddish, with thinner gray pollen on disk which bears numerous erect bristly hairs. Chaetotaxy: Acrostichal, 3, 3; dorsocentral, 3, 4; humeral, 4; posthumeral, 2; notopleural, 2; presutural, 2; intraalar, 3; supraalar, 3; postalar, 2; sternopleural, 2, 2; scutellum with three pairs of laterals, one smaller decussate apical pair, and one pair of discals; post-scutellum well developed, thinly gray pollinose; calypters opaque, white, the rims faintly yellowish.

Abdomen black with a reddish tinge along the sides; intermediate segments gray pollinose on basal two-thirds, the hind margins shining; apical half of fourth also shining, black, the basal pollinose cross band widest at middle above, becoming narrower outward and stopping at side; a median black stripe visible in some angles, not very conspicuous; first segment with one pair of weak median marginals; second also with one pair, larger; third bearing a marginal row of about eight; fourth with several irregular rows on apical half; genitalia small, retracted; inner forceps blackish, long and slender, divided on apical half or more, the tips blunt, not divergent, in profile very straight and almost uniform in thickness from apex to base; outer forceps about three-fourths the length of inner ones, with a broad yellow base, tapering from middle to blunt or rounded tips, which are blackish and beset with very minute black hairs; penis hardly at all thickened apically; fifth sternite with a broad U-shaped incision.

Legs black; middle tibia with two large bristles on outer front side near middle; hind tibia subciliate, the median bristle much stouter and longer; claws and pulvilli exceeding length of apical tarsal joint.

Wings subhyaline, tinged faintly with yellow on costa near base; fourth vein with a sudden rounded bend, concave shortly beyond,

thence continuing diagonally to costa; first posterior cell narrowly open about two-thirds the length of hind crossvein before wing tip; third vein with two or three hairs at base; hind crossvein sinuous, strongly oblique to fourth, which it joins much nearer bend than small crossvein; costal spine inconspicuous.

*Female*.—Front 0.387 of head width (average of six: 0.38, 0.39, 0.40, 0.38, 0.37, 0.40); the usual orbitals present and the outer verticals three-fourths as long as inner; fourth abdominal segment somewhat deflexed, longer and more pointed than in male, sometimes tinged with red at apex, the pollinose cross band is a little wider at sides than at middle above; claws and pulvilli short; genital segments retracted, first one yellow, consisting of a thin-walled tube rather wide in diameter into which the blackish blunt-tipped ovipositor is retracted.

Length, 6 mm. to 8.5 mm.

Described from 143 specimens of both sexes collected at College Station, Tex., April to November, 1917–1930 (H. J. Reinhard); one male from Dilley, Tex., June 6, 1924 (H. J. Reinhard); and one male and two females from Bexar County, Tex., March 8 and April 14, 1929 (H. B. Parks).

*Type*.—Male, U.S.N.M. No. 43270, from College Station, Tex.

#### Genus SIPHOSTURMIOPSIS Townsend

*Siphosturmiopsis* TOWNSEND, *Ins. Insc. Menst.*, vol. 3, p. 91, 1915.

The type and sole original species is *S. rafaeli* Townsend. It was described from one male and two female specimens, which Coquillett had previously determined as *Atacta ruficauda* van der Wulp, although this fact was not mentioned by Townsend. The question of the oldest valid name is left open and can be settled only by examination of Wulp's type in the British Museum.

I have examined Townsend's type series in the National Museum. Briefly, the genus has the same characters throughout as *Siphosturmia* with one important exception. The apical joint of the proboscis is short, hardly equaling one-half the height of head, it is rather thick to the tip, and the labella is distinctly enlarged, soft or almost fleshy in texture. These characters seem sufficient to validate the genus, and two additional species, *melampyga*, new, and *Sturmia phyciodis* Coquillett, are included here. The latter does not possess the peculiar conical and depressed fourth abdominal segment common to the female of the siphosturmine group. In other details, however, the characters agree better with those common to the tribe Siphosturmiini than with *Sturmia*, where it is obviously misplaced.



## KEY TO SPECIES OF SIPHOSTURMIOPSIS

1. With four sternopleurals; mid tibia bearing two bristles near middle on front side; palpi yellow; fourth abdominal segment in female longer than third, depressed, apex pointed.....2  
 With three sternopleurals; mid tibia bearing one bristle near middle on front side; palpi usually black; fourth abdominal segment in female ordinary, apex truncate—(*Sturmia*) *phyciodis* Coquillett
2. Apex of abdomen black; parafacial at narrowest one-third width of face below; ocellars strong (female only).....*melampyga*, new species  
 Apex of abdomen yellow; parafacial at narrowest nearly one-half the width of face below; ocellars small in female, hair-like in male.....*rafaeli* Townsend

## SIPHOSTURMIOPSIS RAFAELI Townsend

*Siphosturmiopsis rafaeli* TOWNSEND, Ins. Insc. Menst., vol. 3, p. 91, 1915.

A rather robust species like *S. melampyga*, from which it differs most obviously in having the apex of the abdomen reddish-yellow. The parafacials are wider; the second antennal joint is one-half as long as the third in the female; and the ocellar bristles, in both sexes, are poorly developed, almost hairlike in male. These items with the description appear sufficient to distinguish the species.

*Type locality*.—San Rafael, Vera Cruz, Mexico.

## SIPHOSTURMIOPSIS MELAMPYGA, new species

*Female*.—Front at vertex 0.35 of head width in both specimens, widening only slightly below, with gray pollen more or less tinged with yellow toward vertex; median stripe reddish, not narrowed before triangle, where the width slightly exceeds that of the parafrontal; the latter with numerous fine hairs, which extend close to the border of the eye; inner verticals strong, reclinate, the outer about three-fourths as long, curving backward and outward; frontal bristles about eight in a row, the uppermost one largest, reclinate, the lowest one at middle of parafacial and on level with apex of second antennal joint; a secondary irregular row of three or four frontals outside of the main row on lower part; ocellar triangle bearing a pair strong proclinate bristles and numerous erect hairs, postocellars well developed; orbital bristles present; parafacials distinctly narrowed downward but at narrowest point much wider than third antennal joint, densely gray pollinose, with a weak bristle and several pale hairs beneath lowermost frontal, bare below; face covered with thick gray pollen, very flat with the lower border protuberant; ridges bare except a few bristles and hairs near base; vibrissae somewhat approximated and situated well above the oral margin; first and second joints of antennae reddish-yellow, third black, one and one-half times the length of second joint;

arista black, of moderate length, a little thickened to or slightly beyond middle, length of penultimate joint about twice its width; proboscis hardly equaling the height of head, distal joint moderately stout; labella somewhat fleshy but not very large; palpi yellow, thickened and strongly bowed upward on apical half, bearing long black hairs on the lower edge; cheeks gray pollinose, clothed with short fine hairs, about one-fifth the eye height; beard dense, whitish; eyes bare.

Thorax black with gray pollen; when viewed from behind five dorsal black stripes apparent, the median one becoming indistinct anteriorly, the outer pair broadest, interrupted at suture, and the intermediate ones obsolete shortly behind suture; scutellum wholly reddish, covered with changeable grayish-white pollen appearing denser and almost silvery in a very flat rear view. Chaetotaxy: Acrostichal, 3, 3; dorsocentral, 3, 4; humeral, 4; posthumeral, 3 (anterior one small); presutural, 2; notopleural, 2; intraalar, 3 (none near suture); supraalar, 3; postalar, 2; pteropleural, 1; sternopleural, 2, 2; scutellum with one discal, three marginal, and a rather long decussate apical pair, disk covered with erect short bristly hairs becoming spiny toward apex; postscutellum normal, gray pollinose; sides of postnotum below calypters bare; calypters opaque, white with yellow rims.

Abdomen black in ground color, the sides of first three segments reddish, fourth entirely black, conical, pointed, and noticeably deflexed; with gray pollen on bases of last three segments extending on the venter, the posterior third of intermediate segments and apical half of fourth shining black; first segment with a pair of smallish median marginals, second with a larger pair, third with a marginal row of about 12 bristles, fourth with numerous erect spiny bristles over most of its surface, the basal ones longest, becoming shorter and weaker toward apex; genitalia retracted but evidently without a piercing organ.

Legs stout, black; middle tibia with three or four large bristles on outer front side; hind tibia ciliated on outer posterior edge with one long bristle beyond middle; claws and pulvilli not elongate.

Wings subhyaline; costal spine inconspicuous; veins bare except third, which has two to four setules near base; fourth vein with a right-angular bend curving outward shortly beyond and continuing almost straight to costa, leaving the first posterior cell rather broadly open far before the wing tip; hind crossvein joining fourth much nearer to bend than small crossvein.

Length, 10 mm.

Described from two females collected at College Station, Tex., October 9 and 20, 1919 (H. J. Reinhard).

*Type*.—Female, U.S.N.M. No. 43271.

## SIPHOSTURMIOPSIS PHYCIDIS Coquillett

*Sturmia phyciodis* COQUILLETT, Revis. Tachin., p. 109, 1897.

Coquillett's description fits the species very well, except that the estimate given of the frontal width, especially that for the male sex, is too narrow. Several additional items not mentioned in the original description are included below:

Front in male 0.274, in female 0.306, of the head width (10 specimens measured in both); parafrontals yellow to golden pollinose, sides of face and cheeks paler in color. Thoracic chaetotaxy: Acrostichal, 3, 3; dorsocentral, 3, 4; intraalar, 3; supraalar, 3; postalar, 2; notopleural, 2; presutural, 2; posthumeral, 2; humeral, 4; pteropleural, 1 (small); sternopleural, 2, 1. Abdomen with a pair of median marginals on first and second segments (small on first); third bearing a marginal row of 10 to 12; fourth with a discal row and numerous irregularly placed smaller bristles behind. In the male genitalia the inner forceps are united at the base, divided but not divergent at apex, on the hind side with a large brownish pad thickly covered with soft short pale hairs, rather striking; outer forceps nearly as long as inner pair, yellow at base, moderately slender beyond middle, tips black, acute, curving forward more abruptly than inner ones; fifth sternite reddish, with a broad U-shaped incision, the lobes bearing a few fine black hairs.

The species ranges from Texas to Ohio and Massachusetts. In my collection there are 86 specimens from College Station, Tex., taken from April to November. The palpi are usually black but sometimes entirely yellow, and there is an occasional specimen with the front wholly gray.



# A NEW PEARL OYSTER FROM THE HAWAIIAN ISLANDS

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By PAUL BARTSCH

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The explorations of the Pearl and Hermes reefs and the waters of Oahu, Hawaiian Islands, last summer by Dr. Paul S. Galtsoff, of the United States Bureau of Fisheries, yielded a lot of material which plainly shows that the large pearl oyster of these regions is not *Pinctada cumingi* Reeve as usually considered, but a new species, which I take pleasure in naming for Doctor Galtsoff, who has transmitted his material to me for identification.

## PINCTADA GALTSOFFI, new species

Plates 1 and 2, figures 1, 2, and 3; figures 7 and 8, type

*Description*.—Shell large, varying in shape from irregularly ovate to subquadrate, rather compressed. Hinge oblique, rather short and deep; byssal notch of the right valve deeply infolded. The outside of the shell is much laminated. In old shells, like the type, these laminations do not show the fimbriations at the free border present in young individuals. The outside is covered by a yellowish-olive periostracum. The nacre of the inside is lustrous silvery pearly gray, with a bluish tinge sometimes bordering on purple near the edge in old shells, as in the type. The outer margin in the type is yellowish horn-colored. In young specimens a band near the edge of the nacreous portion may be gold green with a greenish tinge or smoky with a greenish suffusion and decidedly iridescent. The marginal border in young individuals may be brown, variegated with radiating bands of darker brown or the edge may be quite deeply smoke gray or almost sooty black. Adductor muscle scar large, a little paler than the rest.

*Type*.—The type, U.S.N.M. No. 282426, comes from the Pearl and Hermes reefs, and measures: Altitude, 288.0 mm.; length, 233.0 mm.; thickness, 75.0 mm.

*Remarks.*—The United States National Museum contains other specimens from the Pearl and Hermes reefs, as well as from the islands of Maui, Oahu, and Hawaii.

The short hinge and deeply folded byssal notch suggest a decided relationship with *Pinctada margaritifera* (Linnaeus). This becomes emphasized in young shells, which have the dark marginal border characteristic of the dark-lipped shells. The yellow edge of adult shells, on the other hand, suggests *Pinctada maxima* (Jameson), from which it may be at once distinguished by the short and more oblique hinge. Some young specimens of the present species suggest *Pinctada margaritifera cumingi* (Reeve). This, however, is a much smaller species with decidedly darker inner border; it also has a much more strongly rayed exterior, and comes from Lord Hood Island, situated on the Paumotu shelf, which is quite distinct from the platform of the Hawaiian group.

I have attempted to show some of these differences in the plates.

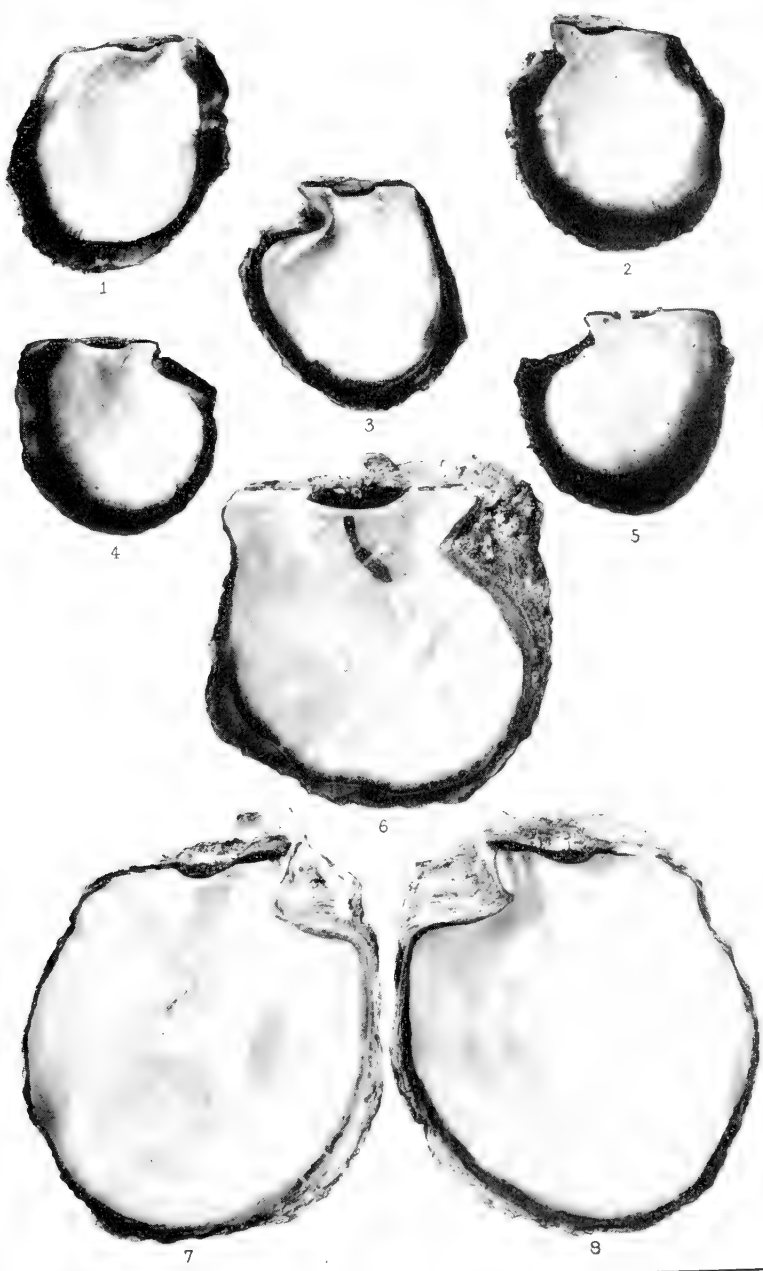
#### EXPLANATION OF PLATES 1 AND 2

FIGURES 1, 2, 3. *Pinctada galtsoffi*, new species.

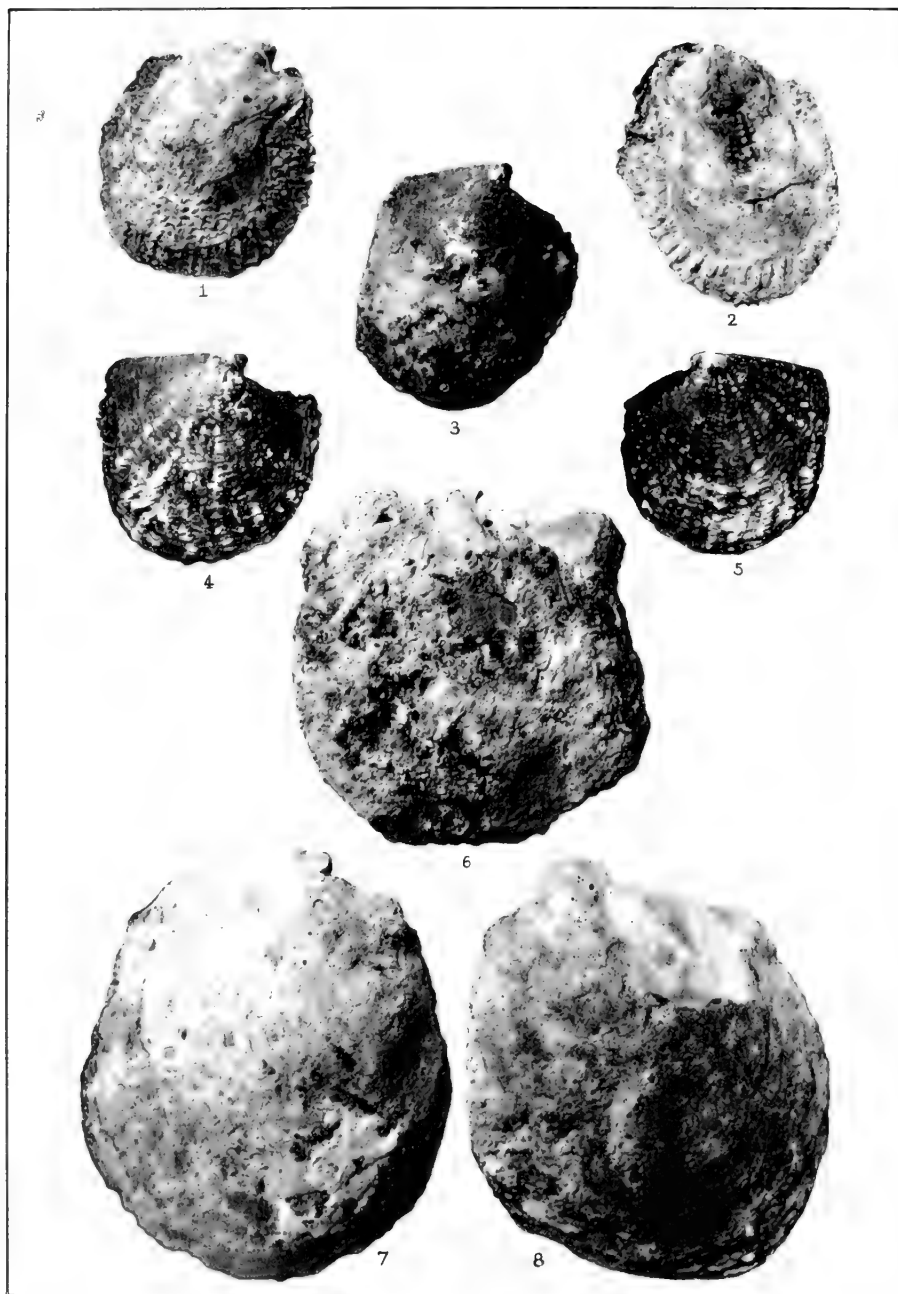
4, 5. *Pinctada margaritifera cumingi* (Reeve) from Raiatea Island, Society Islands.

6. *Pinctada maxima* (Jameson) from Bubuan Island, Jolo, Philippine Islands.

7, 8. *Pinctada galtsoffi*, new species. Type specimen.



INTERIOR OF SPECIES OF PINCTADA  
FOR EXPLANATION OF PLATE SEE PAGE 2.



EXTERIOR OF SPECIES OF PINCTADA

FOR EXPLANATION OF PLATE SEE PAGE 2.



# NOTES ON AND DESCRIPTIONS OF SOME AMERICAN MOTHS

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The notes and descriptions in this paper are offered in response to requests for determinations. One genus, 10 species, and one variety of American moths are described as new. One old species is referred to synonymy, a new food-plant record is given, and the genitalia of seven previously described species are figured.

## Family GEOMETRIDAE

### Subfamily GEOMETRINAE

#### GALENARA CONSIMILIS, new species

#### PLATE 1, FIGURES 2, 3, 4

*Description*.—Palpus brown, ochereous on inner side. Face ochereous-brown. Thorax brown. Forewing brown faintly shaded with ashy white, the whitish color forming a pale diffused outer border to t. a. line, a rather large pale spot beyond cell, and a pale suffusion near tornus; t. a. line sinuate, rather well defined; median dark band poorly defined, fusing more or less with a broad dark postmedian shade; a distinct blackish-brown incurved line on outer margin of cell and a similar incurved line below from vein 2 to dorsum, but (in the male at least) no defined postmedian line; s. t. line blackish brown, discontinuous (broken between veins 3 and 4), outwardly edged with clear white; area bordering termen slightly paler than ground color of remainder of forewing, but not white; terminal line scalloped, black; cilia pale smoky fuscous. Hind wing pale smoky fuscous, somewhat darker outwardly; terminal line dark brown; a white spot at anal angle margined inwardly by a blackish streak; cilia pale smoky fuscous.

Genitalia figured from type and paratype.

*Alar expanse*.—34 to 45 mm.

*Type and paratypes*.—U.S.N.M. No. 43250.

*Type locality*.—Cloudcroft Reserve, Reservoir Cañon, Lincoln National Forest, N. Mex.

*Food plant*.—Douglas fir (*Pseudotsuga taxifolia*).

*Remarks*.—Described from male type and four male and one female paratypes from the type locality and reared under Hopkins U. S. No. 18083 from larvae defoliating Douglas fir (H. E. Burke, collector). Moths issued November 20 and 26 and December 1, 3, and 29, 1928. In September of 1928 the caterpillars were reported as doing considerable damage to the trees.

The species is close to and easily confused with *G. lixaria* Grote, from which it is distinguished in markings chiefly by the clear white line bordering the dark subterminal line. In *lixaria* and *lallata* Hulst the white border of the s. t. line is always more or less speckled with fuscous. The male and female genitalia readily separate *consimilis* from anything in the Cleorine group, the hooked apex of aedoeagus and single strong cornutus at once identifying the male. Male genitalia of the other species of *Galenara* have been figured by McDunnough.<sup>1</sup> I add here a drawing of the female genitalia of *lixaria* (pl. 1, fig. 1) to show the differences from those of the new species. The venation of *consimilis* is normal except that the forewing has veins 10 and 11 short stalked in both sexes. Unfortunately all the specimens except one male paratype are rubbed and in very poor condition, so the pattern of the female could not be described. It seems to have a rather well-marked, almost straight t. p. line on forewing and a narrow dark transverse line on outer half of hind wing, at least from inner margin to about vein 5. Neither of these is distinguishable in the male.

## Family EPIPYROPIDAE

### EPIPYROPS CUCULLATA, new species

#### PLATE 2, FIGURES 5, 7, 8, 9

*Description*.—A small blackish fuscous species hardly distinguishable from *barberiana* Dyar except on genitalia characters. Fore and hind wings concolorous. Head and thorax a trifle darker.

Male genitalia figured.

*Alar expanse*.—10 mm.

*Type*.—U.S.N.M. No. 43251.

*Type locality*.—Port au Prince, Haiti.

*Remarks*.—Described from the male type reared by H. L. Dozier from a white semiovoid cocoon found on the leaf of an unidentified vine and sent by him with letter of January 4, 1930. The host of the

<sup>1</sup> Bull. 18, Ent. Branch Canadian Dept. Agr., pp. 14–15, 1920.

larva was not discovered, but it should prove to be a species of Fulgoridae (the normal host of the Epipyropidae). The known species of Epipyropidae are few and easily separated by structural characters. This new species can be recognized at once by its small size and the enlarged cucullate tegumen of its genitalia. Only two other American species could possibly be confused with it, *E. barberiana* Dyar from Texas, which differs strikingly in every detail of the genitalia (pl. 2, fig. 6), and *Oedonia exigua* Hy Edwards from Arizona formerly placed in the Psychidae but recently identified as an Epipyropid by Frank Morton Jones,<sup>2</sup> who has sent me a sketch of the venation and antenna of *exigua*. They agree substantially with those of *cucullata* and *barberiana*. The type of *exigua* (a female) is in the National Museum collection, and is somewhat larger than the males of either *barberiana* or *cucullata*. Mr. Jones has a couple of other specimens, also females. Unfortunately we know only males of *barberiana* and *cucullata* and only females of Edwards's species.

I am inclined to believe that when a male of *exigua* is discovered it will prove to be a true *Epipyrops* and possibly the same as *barberiana*. The distribution of the two (Texas and Arizona) would suggest this.

Dyar<sup>3</sup> has given a good description of the *Epipyrops* larva in his paper on *E. barberiana*, and Jordan<sup>4</sup> has described and figured the venation and genitalia of several exotic adults; but so far as I know no one has treated the pupa. I, therefore, include drawings (pl. 2, figs. 8, 9) of the pupa of *cucullata*. It shows striking similarity (except in its small size and more dilated antennal case) to that of *Lagoa* in the Megalopygidae. The male genitalia of Epipyropidae resemble most those of the Dalceridae. The two families are closely related, differing in genitalia chiefly in the development of vinculum and anellus. Other obvious genitalic differences in the two families are chiefly of specific or generic significance.

## Family PYRALIDAE

### Subfamily CRAMBINAE

#### DIATRAEA CONSIDERATA, new species

#### PLATE 3, FIGURES 10, 12

*Description*.—A large species allied to *D. magnifactella* Dyar, the sexes showing marked contrast in color.

Male dark grayish fuscous with concolorous hind wing. Female pale brownish straw color with pure white hind wing. Outer cross

<sup>2</sup> Texas Agr. Exp. Stat. Bull. 382, p. 8, footnote, 1928.

<sup>3</sup> Proc. Ent. Soc. Washington, vol. 5, p. 44, 1902.

<sup>4</sup> Nov. Zool., vol. 34, pp. 136-140, pls. 1-3, 1928.

line on fore wing distinct in both sexes, consisting of a series of dots on the veins with a thin sharply angulate line between each dot; inner line obscure, somewhat more distinct in the male; discal dot small, terminal dots distinct. Front with a tubercle. Hind tibia of male without hair tuft.

Male genitalia distinguished by the greatly enlarged and coarsely spined projection from costal base of harpe. Lateral lobes of tegumen rounded. Gnathos weakly spined toward apex.

Female genitalia like those of *magnifactella*.<sup>5</sup>

*Alar expanse*.—Male, 31 mm.; female, 39 mm.

*Types and paratypes*.—U.S.N.M. No. 43252.

*Type locality*.—Eldorado, Sinoloa, Mexico.

*Food plant*.—Sugarcane (*Saccharum officinarum*).

*Remarks*.—Described from male type and one male and one female paratype from the type locality ("2-11-29," "2-10-29," S. E. Flanders).

DIATRAEA BUSCKELLA ROSA, new variety

A Venezuelan race agreeing with typical *busckella* in genitalia; but with a distinctly pinkish ochereous tint on fore wings of both sexes. Typical *busckella* is pale straw color.

*Alar expanse*.—Male, 29 mm.; female, 38 mm.

*Type and paratypes*.—U.S.N.M. No. 43253.

*Type locality*.—Carabobo, Venezuela.

*Food plant*.—Sugarcane.

Described from male type, 6 male and 5 female paratypes from the type locality (H. T. Osborn, 1929) and 3 male and 1 female paratypes from Caracas, Venezuela (A. Ibarra), all reared from larvae boring in sugarcane.

PLATYTES (?) AENIGMATICA, new species

PLATE 3, FIGURE 11

*Description*.—Labial palpus projecting one and one-half times the length of the head beyond it, porrect; fuscous on outer side, white beneath and on inner side. Head, thorax, and fore wing pale straw color; a conspicuous black dot at end of cell and a sparse scattering of black scales over rest of wing (these black scales very few, widely separated, and noticeable only under magnification); wing otherwise unmarked. Hind wing cream white.

Female genitalia figured from type.

*Alar expanse*.—26 mm.

*Type*.—U.S.N.M. No. 43254.

*Type locality*.—Gunnison, Colo.

*Food plant*.—Thistle (*Cirsium* sp.)

<sup>5</sup> For genitalia of the American *Diatraea* see Dyar and Heinrich, Proc. U. S. Nat. Mus., vol. 71, no. 2691, pp. 1-48, pls. 1-20, 1927.

*Remarks.*—Described from reared female type (August 5, 1924, Henry Bird). Mr. Bird has kindly supplied the following biological note:

In a survey for *Papaipema* larvae through a portion of Colorado, in 1924, thistles were considered a possibility and a large number were examined. The only flagrant lepidopterous infestation noted was at Gunnison, where a large species, seemingly a *Cirsium* of the *undulata* group, but not yet in flower, was infested by Pyralid-like larvae, six or eight often mining a single stem. Their operation causes the top of the plant to blacken and droop, easily advertising infestation. Because of the apparent localization, breeding the moth seemed desirable.

The larvae were active, with tubercles prominent, spinning random strands which helped to retain the frass in the hollow stem at the workings.

Being moist, this residue furnished medium for a dipterous larva, while a hymenopterous species, in puparium, was noted to have worked as primary parasite, undoubtedly upon the miner. Subsequently a sample of both these associated species was reared.”<sup>6</sup>

The moth is easily distinguished by genitalia and pattern. It fits equally badly in *Platytes* and *Chilo*. The front is neither evenly rounded as in typical *Platytes* nor conically produced as in *Chilo* but projects forward and downward. The costa of fore wing is different also, being slightly convex toward apex. The species probably deserves a new generic designation, but this can wait upon the discovery of the male.

#### Subfamily PYRALINAE

#### AGLOSSA FURVA, new species

#### PLATE 4, FIGURES 13, 14

*Description.*—A moderately sized species with dark fore and hind wings.

Antenna ochereous shaded above with blackish fuscous. Palpus, head, and thorax blackish fuscous more or less spotted with ochereous. Fore wing blackish fuscous with an angulate transverse band from costa beyond base and reaching almost to dorsum, a rounded ochereous black-centered spot near end of cell, a rather conspicuous ochereous spot on costa before apex, and a faint purplish ochereous shading toward termen; cilia smoky, but slightly paler than dark ground color of wing. Hind wing blackish-smoky-fuscous; cilia slightly paler with no dark basal band.

Genitalia figured from male type and female paratype (the latter from Vancouver Island).

*Alar expanse.*—23 to 28 mm.

*Type and paratypes.*—U.S.N.M. No. 43255; paratypes also in collection of John F. Clarke.

<sup>6</sup> The dipteran has been determined by C. T. Greene as *Sphaerophoria sulphuripes* Thomson; and the hymenopterous parasite by R. A. Cushman as *Amblyteles* sp.

*Type locality*.—British Columbia.

*Food plant*.—Unknown.

*Remarks*.—Described from male type and one male paratype from British Columbia but without definite locality label ("9-7-25" and "9-8-25," Blackmore Nos. 85 and 86); one male paratype from Saanichton, British Columbia ("31-VII-1922," John G. Colville, "397"); one male paratype from Departure Bay, British Columbia ("21-7-08," Blackmore No. 598); one male paratype and one female paratype from Quamichan Lake, Vancouver Island ("16-VII-22" and "11-VII-08," Blackmore Nos. 399 and 398).

The new species is at once distinguished by its exceptionally dark hind wings. *A. gigantalis* Barnes and Benjamin, the darkest of previously described species, shows more contrast in fore and hind wings and is a much larger insect. The genitalia of the various *Aglossa* are quite similar, displaying slight but apparently consistent differences. *A. cuprialis* Hübner has a narrow, distinctly chitinized trans-tilla lacking in the other species. The harpes of *cuprialis*, *cuprina* Zeller, and *baba* Dyar are broader and more abruptly tapering toward apex. The aedoeagus is at least one-third shorter in proportion to its diameter in *baba* than in *cuprina*, *cuprialis*, or *furva*; while *acallalis* Dyar has an aedoeagus of different shape from that of all the other species, the organ being much more slender on basal three quarters. *A. oculalis* Hampson (from Texas) I do not know. This species, however, has pale hind wings.

## Family OLETHREUTIDAE

### Subfamily LASPEYRESIINAE

#### GYMNANDROSOMA DESOTANUM Heinrich

#### PLATE 5, FIGURE 18

*Remarks*.—In addition to the original female paratype we now have in the National Museum collection two males and a female from Miami Beach, Fla., reared by T. E. Snyder, June 30, August 10, and July 21, 1916, from larvae feeding in red-mangrove seed. The males have the secondary characters (tufted hind tibiae and hair pencil) decidedly less developed than those of *punctidiscanum* Dyar. Vein 5 of the hind wing is also appreciably bent toward the base in both sexes. The male genitalia, however, show that *desotanum* must be associated with *punctidiscanum*, the only striking difference being in the shape of the cucullus of the harpe. This is shorter and has more of a projection at neck in *desotanum* than in Dyar's species.

Male genitalia figured.

## Subfamily EUCOSMINAE

**THIODIA IMPLICATA**, new species

*Description*.—A white species with pale ochereous-fuscos basal patch and outer fascia.

Palpus, face, head, and thorax white. Fore wing white with dark markings pale ochereous-fuscos; an outwardly angulate basal patch not reaching costa and broken longitudinally by streaks of the white ground color; costa from base to middle pure white, unmarked; from just beyond middle a dark band slanting outward to upper inner edge of ocelloid patch and joining a vertical shade of the same color from tornus, forming with it a complete angulate fascia; on outer half of costa three conspicuous dark spots; ocelloid patch white containing two black streaks and shaded above by ochereous-fuscos; cilia white heavily peppered with fuscous and blackish scales. Hind wing very pale smoky fuscous; cilia white.

Male genitalia as in *striatana occidentalis*.

*Alar expanse*.—17 to 20 mm.

*Type and paratypes*.—U.S.N.M. No. 43256; paratypes in Clarke, American Museum, and Canadian national collections.

*Type locality*.—Rochester, Wash.

*Food plant*.—Unknown.

*Remarks*.—Described from male type, seven male paratypes from the type locality ("13-VI-29" and "26-VI-29," W. W. Baker), and one male paratype from Wellington, British Columbia (Theo. Bryant, collector, "Blackmore No. 890), all received from John F. Clarke.

This species is close to and possibly another extreme variety of *striatana* Clemens but differs so markedly from it and its other western variety (*occidentalis*) in pattern that I hesitate to name it anything but a distinct species.

**GRETCHENA DULCIANA** Heinrich

The food plant of this species is alder (*Alnus*). The larvae tie the tender terminal leaves in a small compact bundle and feed within the tie. From larvae collected by the writer early in July, 1918, near Marlboro, Md., a moth (male) issued July 24.

**EPINOTIA OPPOSITA**, new species

PLATE 6, FIGURE 21; PLATE 7, FIGURE 26

*Description*.—A species allied to *patriciana* Walsingham, with different wing pattern in male and female, a costal fold inclosing a strong scale tuft on male fore wing, and conspicuous black sex scaling on hind wing, abdomen, and hind tibiae of the male.

*Male*.—Antenna, palpus, head, and thorax dark grayish fuscous; the scale ends paler; a black spot on basal segment of antenna; inner side of palpus whitish. Fore wing grayish fuscous with dorsal half somewhat paler; a rather broad costal fold, not reaching to middle of wing, inclosing a thick tuft of yellowish scales interspersed with a few black scales; a very sparse dusting of black scales on costal half of wing; costa faintly striated; a blackish dot at apex and a curved black line over ocelloid patch; latter consisting of two obscure vertical metallic bars inclosing two faint black dots on a pale ground; veins 3, 4, and 5 approximate toward termen; termen concave. Hind wing pale smoky fuscous; hair on cubitus in the form of a thick pale tuft (similar to that of *Crocidosema plebeiana*) at base followed by a line of whitish hairs beyond; a long yellow hair pencil from extreme base; black sex scaling on anal area to and including vein 1b, on area between cell and costa and along upper and lower veins of cell; the sex scaling repeated upon the same areas on under side of hind wing; cell clear, somewhat paler than remainder of wing; cilia pale with dark basal band, whitish at inner angle. Under side of fore wing with area of the fold distinctly ocherous and rough scaled; costal half of wing (except for area under the fold) from dorsal margin of cell and to end of cell covered with black sex scaling. Similar black scaling on dorsum of abdomen and on tibia of metathoracic leg. Throughout, the black sex scales are overlaid but not obscured by a scattered dusting of white scales.

*Female*.—Differs from the male in having no black sex scaling; in having the costal area of fore wing paler than the dorsal and the head and thorax darker. Fore wing with a blackish-brown incomplete basal patch on dorsum; a similarly colored patch on dorsum before tornus; area between them whitish or whitish ocherous; on disk above this an oblong dark (brown or blackish) patch; remainder of wing pale ocherous-brown with a faint rosy tint; costal striae brown interspaced beyond middle with sordid white; apical dark dot conspicuous. Hind wing very pale smoky fuscous, darker toward apex and termen; cilia slightly paler, with a dark basal band.

Genitalia figured from type (male) and paratype (female) from the type locality.

*Alar expanse*.—12.5 to 15.5 mm.

*Type and paratypes*.—U.S.N.M. No. 43257; paratype also in Cornell University collection.

*Type locality*.—Lima, Peru.

*Food plant*.—Alfalfa (*Medicago*), cowpeas (*Vigna*).

*Remarks*.—Described from male type and 3 male and 11 female paratypes reared from larvae boring in stems of cowpeas and referred by Dr. Johannes Wille under No. 154-29; 1 male and 1 female paratype labeled "On Palms, E. Gandron, collector;" 1



male and 1 female paratype reared from buds of alfalfa, February 15, 1915 (E. Gandron), all from the type locality; also 1 male paratype from Matucana, Peru (Cornell University Expedition, lot 607, collected May 27, 1920).

In addition to the above I have examined a male from Purulha, Guatemala, a male from La Florida, Costa Rica, and three females from Costa Rica that are presumably conspecific, certainly nothing more than a local race of this species. In the fore wings of both sexes there is a black streak extending back to the cell from the curved line over the ocelloid patch much as in *aporema* Walsingham. I am unable to find any trace of this in the Peruvian specimens. There are no other differences and the genitalia (male and female) of the two forms agree.

This species is very close to *patriciana* Walsingham and the following new species (*accessa*). All three have similar sex scaling in the male, a similar pattern scheme, and similar scale tufts under the costal fold in male fore wing. They differ rather strikingly in genitalia and in several male characters. In *accessa* the costal fold extends to well beyond middle of costa, the thick hair tuft on cubitus of hind wing is dark smoky fuscous, and the hair pencil from base of hind wing is lacking. In *patriciana* the costal fold is short as in *opposita*, but the hair pencil and cilia at inner angle of hind wing are black and the pecten on cubitus is not developed into a tuft as in the other two species.

EPINOTIA ACCESSA, new species

PLATE 6, FIGURE 20; PLATE 7, FIGURE 24

*Description*.—Similar to *E. opposita* in pattern and color; but showing important genitalic and other differences.

The fore wing of the male has a rolled-over costal fold, which extends to well beyond middle of costa; a black suffusion on dorsum at base; an extended blackish suffusion over costal half of wing from base to beyond cell. Hind wing dark brown with black sex scaling on anal area and more or less along veins; a blackish fuscous scale tuft on cubitus near base; no appreciable hair pencil from extreme base of wing. Black sex scaling on under side of fore and hind wings, abdomen, and hind tibiae, as in *opposita*.

Female as in *opposita*, except for a very slight olive-green shading on dorsal dark areas of fore wing and for the position of the genital opening, the latter being more caudally placed in *opposita* (compare pl. 7, figs. 24 and 26). In superficial appearance females of *accessa* also resemble those of *Crociosema plebeiana* Zeller and *Epinotia lantana* Busck. Both of these are easily separated on genitalic characters (see pl. 7, figs. 23 and 25). Their males need not be confused,

as they lack the characteristic black sex scaling of *accessa*, *opposita*, and *patriciana*.

Genitalia figured from type (male) and paratype (female) from the type locality.

*Alar expanse*.—12.5 to 15.5 mm.

*Type and paratypes*.—U.S.N.M. No. 43258.

*Type locality*.—Trinidad River, Panama.

*Food plant*.—Unknown.

*Remarks*.—Described from male type and 1 male and 1 female paratype from the type locality (March, 1912, August Busck); 1 female paratype from Cabima, Panama (May, 1912, Busck); 1 male paratype from La Florida, Costa Rica (William Schaus); 1 female paratype from Tuis, Costa Rica (Schaus); and 1 female paratype from Vera Cruz, Mexico (December 14, 1907, Frederick Knab).

EPINOTIA PATRICIANA (Walsingham)

PLATE 6, FIGURE 22

*Eucosma patriciana* WALSINGHAM, Biol. Centr. Amer. Lepid. Heter., vol. 4, p. 232, 1914.

*Remarks*.—Male genitalia figured from paratype in the United States National Museum from Jalapa, Mexico. In addition to this specimen I have examined a male from Volcan Santa Maria, a male from Palin, and a male from Cayuga, Guatemala (Schaus and Barnes, collectors). I do not know the female. The male is easily distinguished from other *Epinotia* that have the black sex scaling by its characteristic genitalia, by the black cilia on inner margin of hind wing, and by the long black hair pencil on the base of the hind wing.

*Alar expanse*.—12 to 14 mm.

*Type*.—In British Museum.

*Type locality*.—Teapa, Mexico.

*Food plant*.—Unknown.

EPINOTIA LANTANA (Busck)

PLATE 6, FIGURE 19; PLATE 7, FIGURE 25

*Crociosema lantana* BUSCK, Proc. Ent. Soc. Washington, vol. 12, pp. 132–133, 1910.

*Eucosma lantana* (BUSCK) WALSINGHAM, Biol. Centr. Amer. Lepid. Heter., vol. 4, p. 233, 1914.

*Remarks*.—Genitalia figured from male type and female paratype from Tantalus, Oahu, Hawaii. The male genitalia are similar to those of *opposita*, showing only a trifling difference in the shape of the cucullus of harpe. The female organs, however, are quite different, and the males are otherwise distinct. *E. lantana* has no

black sex scaling, and the front is curiously modified, being deeply grooved to hold the closely appressed, upturned palpi.

*Alar expanse*.—9 to 12 mm.

*Type*.—In National Museum collection.

*Type locality*.—Tantalus, Oahu, T. H.

*Food plant*.—Lantana (*Lantana*).

CROCIDOSEMA PLEBEIANA Zeller

PLATE 7, FIGURE 23

Female genitalia figured from specimen in National Museum collection reared from *Malvaviscus drummondii*, Smith Point, Tex., December 10, 1918 (H. S. Barber).

ANCHYLOPERA BRAUNI, new species

PLATE 5, FIGURE 16

*Description*.—A whitish ochereous species with argus-brown basal patch and a black shading on costa beyond middle; close and similar to *definitivana* Heinrich, but easily distinguished by male genitalia.

Palpus sordid white, the outer side sparsely dusted with blackish fuscous. Head and thorax argus-brown; tegula whitish ochereous at base. Fore wing with basal half of costa and tornal area whitish ochereous, the white in tornal area more or less suffused with brown; a few indistinct short brown strigulae on costa before middle; on costa beyond middle an outwardly slanting blackish band suffusing with a pair of longitudinal black streaks at end of cell, these latter occupying the upper third of a slanting, oblong, brown patch, which extends below the cell to vein 2; dark basal patch with a black shading toward costal margin, with costal margin sharply angled at middle and with outer margin decidedly slanting and slightly notched; cilia fuscous with a whitish band at base. Hind wing dark smoky fuscous, pale toward base; cilia pale smoky fuscous with a dark basal band.

Male genitalia figured from type.

*Alar expanse*.—12 to 14 mm.

*Type and paratypes*.—U.S.N.M. No. 43259; paratypes also in American Museum of Natural History and Miss Braun's collections.

*Type locality*.—Beaver Pond, Adams County, Ohio.

*Food plant*.—Buckthorn (*Rhamnus lanceolata*).

*Remarks*.—Described from male type and 2 male and 4 female paratypes from the type locality (labeled "V-11-27," "VII-10-27," "VII-12-27," "VII-13-27," "VII-14-27" under number "B1305"); 4 female paratypes from Clermont County, Ohio (labeled "IV-1" and "IV-4-16" under number "B897"); and 3 male paratypes from Champaign County, Ohio ("V-11-29"). We are indebted to Dr.

Annette Braun for all the above and for the text figure that accompanies this description. The Adams and Clermont County specimens were reared by her from larvae feeding on leaves of *Rhamnus lanceolata* and the three males from Champaign County were taken resting on *Rhamnus alnifolia*. Regarding the Beaver Bond specimens Doctor Braun writes as follows:

The young larva makes a characteristic fold in the leaf toward its tip, by bringing the outer margin at one point close against the midrib; feeding takes place beyond the fold toward the tip of the leaf (fig. 1, A). As it consumes the leaf in front of it the larva extends the fold backward toward the base of the leaf (fig. 1, B). The larva is pale yellowish, rather translucent, with head about the same color as the rest of the body. Pupa (in breeding jar) in fold, usually at edge of leaf. These notes apply more particularly to the first generation of larvae; by the time the fall generation appears in

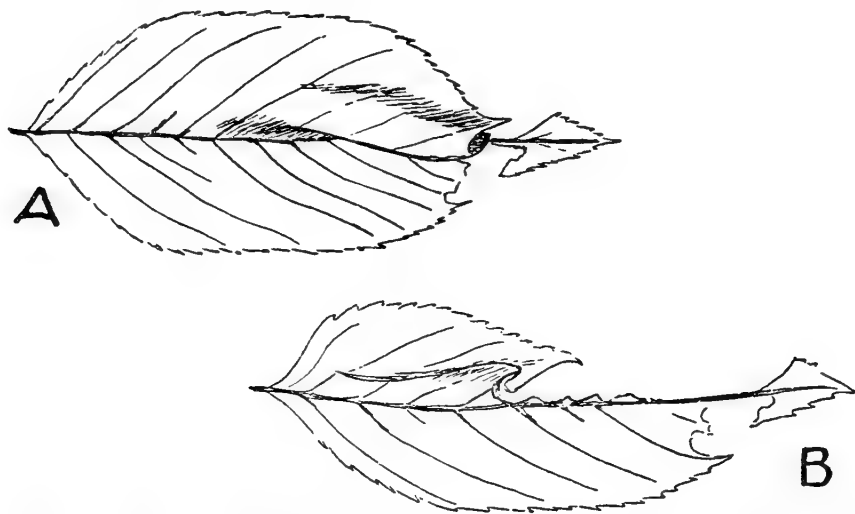


FIGURE 1.—Work of *Anchylopera brauni* on buckthorn (*Rhamnus*) leaf: A, Characteristic fold and beginning of feeding; B, same leaf a week later

September and October, the leaves are usually in rather poor condition from the feeding of other species, specially *Apothysis pullata* and *Nepticula rhamnicola*, and the mode of feeding of the *Anchylopera* is not as characteristic, as the larva may feed at either end of the fold or irregularly.

The species is easily recognized and not to be confused with anything else in the genus except the western *definitivana* from which it is at once separated by its shorter, stouter aedoeagus and differently shaped harpe, the lower margin of the cucullus being convex and evenly rounded in *brauni* and distinctly concave in *definitivana*. The uncus is also proportionally shorter in *brauni*.

ANCHYLOPERA SPIRAEIFOLIANA Clemens

Through the kindness of Miss Braun we now have authentic specimens of this species reared from larvae taken feeding on *Spiraea*

*opulifolia*. These specimens prove that the so-called "type" at Philadelphia is spurious. They agree with Clemens's original description and except in size with *burgessiana* Zeller. The latter may possibly be retained as a race of *spiraeifoliana* on its food plant difference and slightly larger size. I doubt, however, that it is anything more than a synonym. This identification leaves the species previously identified as *spiraeifoliana* and which I figured under that name in my Revision of the Eucosminae<sup>7</sup> without a name. Until we are better informed it may go as *metamelana* Walker. It is quite possible that the name *discigerana* Walker has been incorrectly applied to western specimens. In that case it probably would apply to the *spiraeifoliana* of authors. We shall never clear the muddle of Walker names until his types are reexamined and their genitalia studied.

The Fernald "homotype" of "*spiraeifoliana*" now in the National Museum is a specimen of *angulifasciana* Zeller.

#### Subfamily OLETHREUTINAE

##### SATRONIA TANTILLA Heinrich

#### PLATE 4. FIGURE 15

I have examined a large series of this species reared from longleaf pine (*Pinus palustris*) from Starke, Fla. (May 28 to June 1, 1929, O. L. Harper). The males have all veins in fore wing present and 7 and 8 separate. The genus *Satronia* was described from an abnormal specimen with 7 and 8 united. Since this character does not hold, *Satronia* can only be retained separate from *Goditha* on the subparallel rather than separate and parallel condition of veins 6 and 7 of hind wing. The only other American genus without pecten on the lower median vein of hind wing (*Sereda*) has veins 6 and 7 approximate (tortriciform) toward base. I hesitate to lump *Satronia* with either *Goditha* or *Sereda* on account of its quite differently formed male genitalia, which, except for the absence of socii, most closely resemble those of *Ricula*, a genus easily separated on male and female characters.

The female genitalia of *Satronia* have two thornlike signa in bursa and the ductus bursae strongly chitinized and bent (as in *Sereda*). The female of *Goditha* is unknown.

Female genitalia of *S. tantilla* figured from reared specimens from Starke, Fla.

##### PHAEACASIOPHORA INSPERSA, new species

*Description*.—A pale tawny ochereous species with a very faint ferruginous tint in fresh specimens and no definable basal patch or outer band on fore wing.

<sup>7</sup> U. S. Nat. Mus. Bull. 123, p. 236, 1923.

Palpus ochereous blotched on outer side with fuscous. Basal joint of antenna fuscous. Face and head tawny-ochereous. Thorax and fore wing pale tawny-ochereous peppered with blackish scales, the latter arranged in transverse lines on fore wing and but faintly visible to the naked eye, most conspicuous as a dark shading at end of cell; cilia pale ochereous-ferruginous. Hind wing but slightly darker than fore wing, a trifle more fuscous.

Male genitalia as in *niveiguttana* Grote, except that cucullus of harpe is somewhat more slender.

*Alar expanse*.—18 to 19 mm.

*Type and paratypes*.—U.S.N.M. No. 43260.

*Type locality*.—St. Petersburg, Fla.

*Food plant*.—Unknown.

*Remarks*.—Described from male type and two male paratypes from the type locality ("3-3-15," R. Ludwig).

A distinct and easily recognized species. It lacks altogether the strong pattern markings and white cell dot of the other two species of the genus and has the hind tibia even less tufted than that of *niveiguttana*. Its genitalia, however, are distinctly of *Phaecasiphora* type and scarcely distinguishable from those of *niveiguttana*.

#### TSINILLA, new genus

##### PLATE 5, FIGURE 17

*Genotype*.—*Eucosma lineana* Fernald (North America).

*Description*.—Thorax with posterior tuft.

Fore wing smooth; termen concave; 12 veins, all separate; 7 to termen; 8 and 9 approximate at base; upper internal vein of cell from between 9 and 10; 3, 4, and 5 not approximate at termen; 2 strongly bent and running up to termen parallel to 3; 1c indicated by a distinct fold in the wing in both sexes, the fold running into vein 2.

Hind wing with 8 veins; 6 and 7 approximate toward base; 3 and 4 connate; 5 approximate to 4; termen slightly sinuate below apex; in male a chitinous ridge on inner margin.

Hind tibia of male with hair pencil from base.

Male genitalia with harpe narrowly elongate, rather evenly spined from sacculus to apex; cucullus small, less than half the length of the harpe; cornuti a cluster of long deciduous spines; uncus weakly spined.

Female with two thornlike signa in bursa; ductus bursae moderately long, strongly chitinized toward genital opening.

A monotypical tropical genus extending into southern Florida. Shows affinities to *Eumarozia*, *Zomaria*, and *Hedia*.

*Remarks.*—In my Revision of the Olethreutinae,<sup>8</sup> I placed *lineana* provisionally in *Hedia*, calling attention to its aberrant character (concave termen of fore wing, the strongly bent condition of vein 2, and the origin of upper internal vein of cell from between 9 and 10). At that time we knew only the female. Since then Frank Morton Jones has collected a number of the larvae in southern Florida and reared a series of males and females, which are now in the National Museum collection.

The male genitalia, except for the weakly spined uncus and short cucullus, would not bar the species from *Hedia*, but on other characters it does not fit. The only other American olethreutine genus with concave termen (*Episimus*) lacks the tufted thorax and has veins 3, 4, and 5 decidedly approximate at termen.

Male genitalia figured from specimen reared from larva feeding on *Anona* in southern Florida (issued March 8, 1930, F. M. Jones). Mr. Jones writes of the larval habits as follows:

Almost invariably feeding begins at the tip of the leaf, which is pulled together at the margins, leaving the basal portion of the leaf open and flat; as feeding proceeds and the larva grows larger, the folded-together portion is extended toward the base, until the entire leaf is neatly folded together, its margins meeting more or less evenly; and within the flattened cell thus formed the larva makes transverse partitions of white silk, these partitions more or less evenly spaced. Usually only one larva inhabits a leaf, and when more are present, they are of different ages. Probably one leaf usually suffices for the growth of the larva, but when two leaves are in contact, the infested one is sometimes joined with silk to the adjacent leaf, and both are fed upon. No cocoons or pupae were found in the leaf-nests, though the small white cocoons of a parasite were frequently present. \* \* \* The *Anona* leaf tier makes its cocoon by cutting a flap in a leaf-margin (not the leaf it has fed upon) and folding it over.

#### EXPLANATION OF PLATES

The plates herein were drawn under the author's supervision by Mrs. Eleanor A. Carlin, of the Bureau of Entomology. They are much enlarged but not drawn to a definite scale.

Explanations of symbols applied to genitalia:

<i>Ac.</i> aedoeagus.	<i>Tg.</i> tegumen.
<i>An.</i> anellus.	<i>U.</i> uncus.
<i>Cn.</i> cornutus.	<i>Vm.</i> vinculum.
<i>Gn.</i> gnathos.	<i>Vm. a.</i> bent arm of vinculum forming attachment to tegumen (in <i>Epipyrops</i> ).
<i>Go.</i> genital opening (female).	
<i>Hp.</i> harpe.	
<i>Si.</i> socii.	

<sup>8</sup> U. S. Nat. Mus. Bull. 132, p. 165, 1926.

## Explanation of symbols applied to pupa:

<i>ao.</i> anal opening.	<i>l</i> <sup>2</sup> . mesothoracic leg.
<i>at.</i> antenna.	<i>l</i> <sup>3</sup> . metathoracic leg.
<i>cx</i> <sup>1</sup> . coxa of prothoracic leg.	<i>lb.</i> labrum.
<i>cx</i> <sup>2</sup> . coxa of mesothoracic leg.	<i>lp.</i> labial palpus.
<i>go.</i> genital opening.	<i>md.</i> mandible.
<i>l</i> <sup>1</sup> . prothoracic leg.	<i>mx.</i> maxilla.

## PLATE 1

- FIGURE 1. *Galenara lizaria* (Grote): Female genitalia (ventral view).  
 2. *Galenara consimilis* Heinrich: Male genitalia (ventral view).  
 3. *Galenara consimilis* Heinrich: Female genitalia (ventral view).  
 4. *Galenara consimilis* Heinrich: Part of male abdomen (ventral view) showing intersegmental sex tufts between seventh and eighth segments.

## PLATE 2

- FIGURE 5. *Epipyrops cucullata* Heinrich: Male genitalia (ventral view).  
 6. *Epipyrops barberiana* Dyar: Male genitalia (ventral view).  
 7. *Epipyrops cucullata* Heinrich: Venation of wings (male).  
 8. *Epipyrops cucullata* Heinrich: Pupa, ventral view.  
 9. *Epipyrops cucullata* Heinrich: Pupa, dorsal view of two segments, greatly enlarged to show characteristic scobinations.

## PLATE 3

- FIGURE 10. *Diatraca considerata* Heinrich: Female genitalia (ventral view).  
 11. *Platytes aenigmatica* Heinrich: Female genitalia (ventral view).  
 12. *Diatraca considerata* Heinrich: Male genitalia; *a*=tegumen, uncus, and gnathos (three quarters view); *b*=harpes, vinculum, and anellus (ventral view); *c*=aedoeagus.

## PLATE 4

- FIGURE 13. *Aglossa furva* Heinrich: Female genitalia (ventral view).  
 14. *Aglossa furva* Heinrich: Male genitalia; *a*=aedoeagus; *b*=genitalia with aedoeagus omitted (ventral view).  
 15. *Satronia tantilla* Heinrich: Female genitalia (ventral view).

## PLATE 5

- FIGURE 16. *Anchylopera brauni* Heinrich.  
 17. *Tsinilla lineana* (Fernald).  
 18. *Gymnandrosoma desotatum* Heinrich.

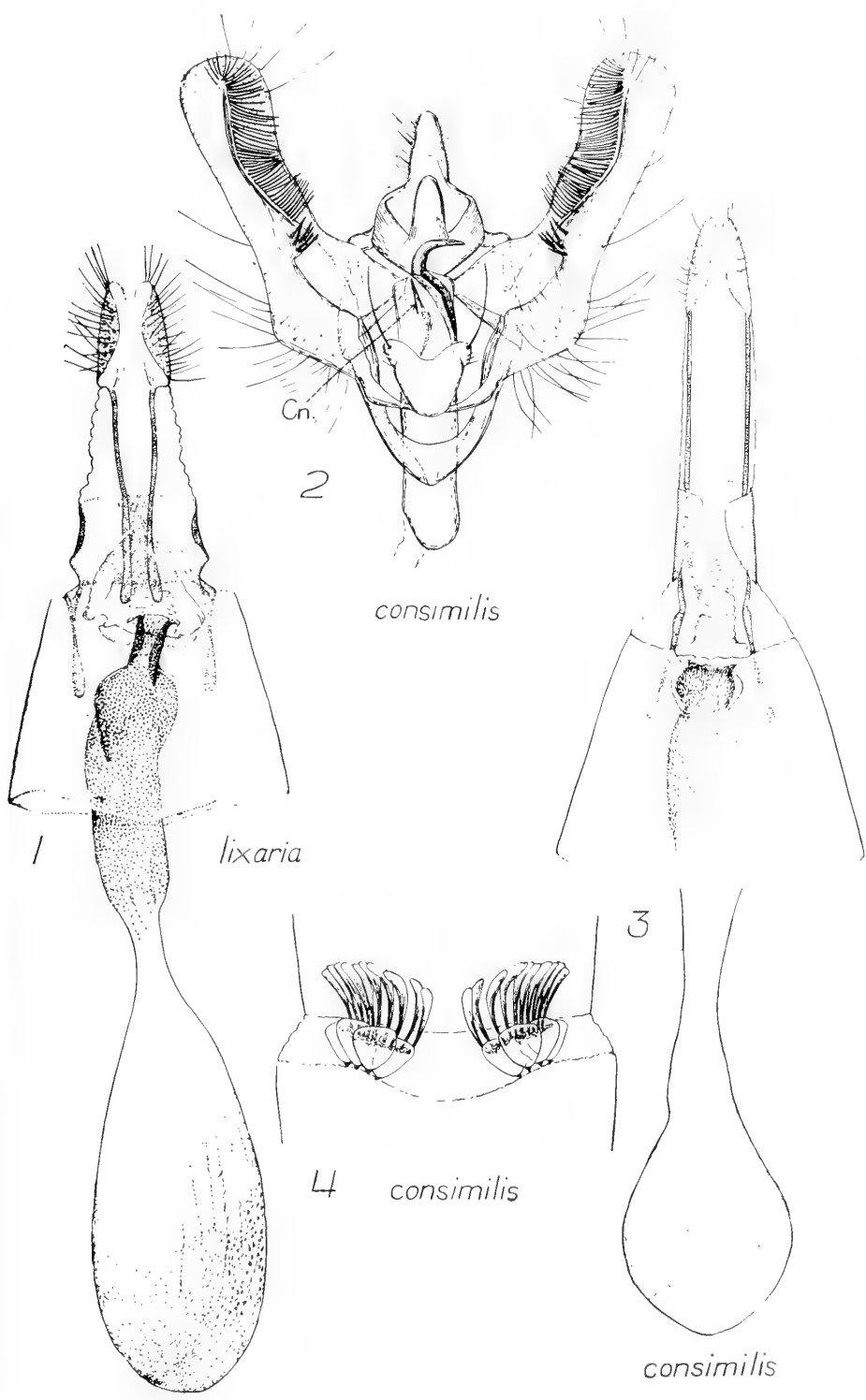
## PLATE 6

- FIGURE 19. *Epinotia lantana* (Busck).  
 20. *Epinotia accessa* Heinrich.  
 21. *Epinotia opposita* Heinrich.  
 22. *Epinotia patriciana* (Walsingham).

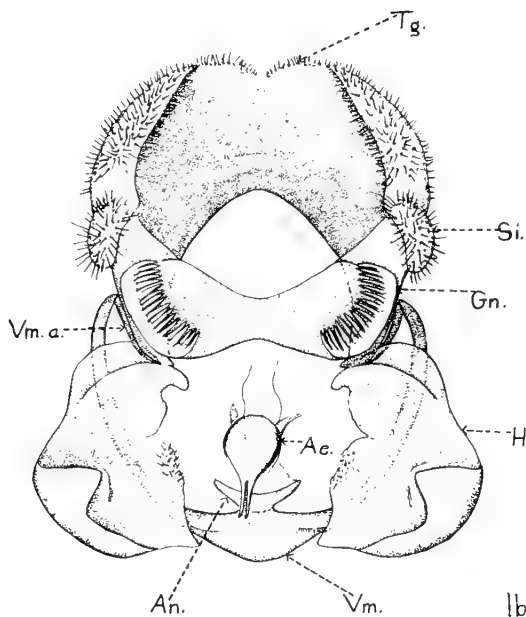
## PLATE 7

- FIGURE 23. *Crociosema plebeiana* Zeller.  
 24. *Epinotia accessa* Heinrich.  
 25. *Epinotia lantana* (Busck).  
 26. *Epinotia opposita* Heinrich.

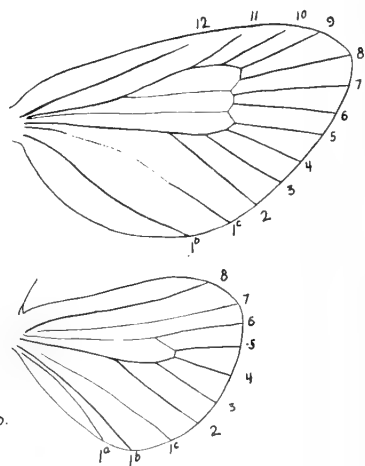




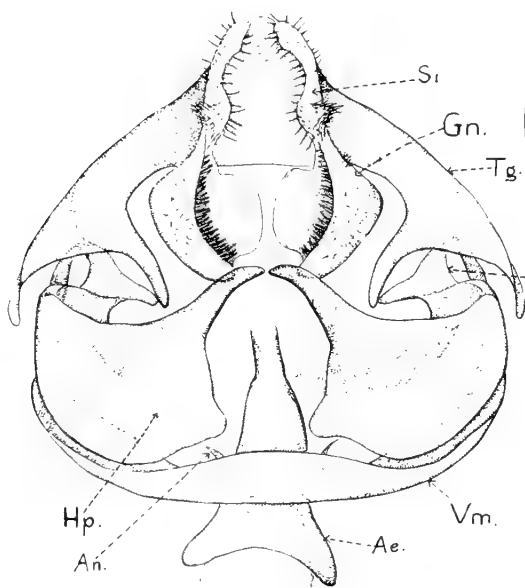
STRUCTURAL CHARACTERS OF *GALENARA*  
FOR EXPLANATION OF PLATE SEE PAGE 16.



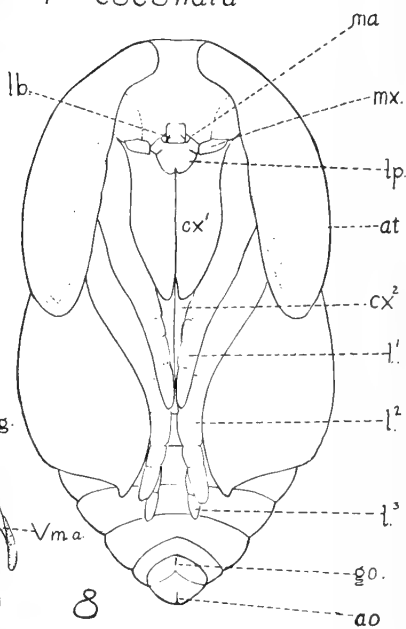
5 *cucullata*



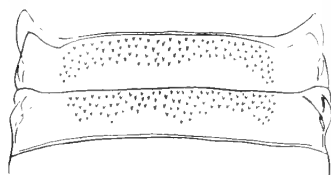
7 cucullata



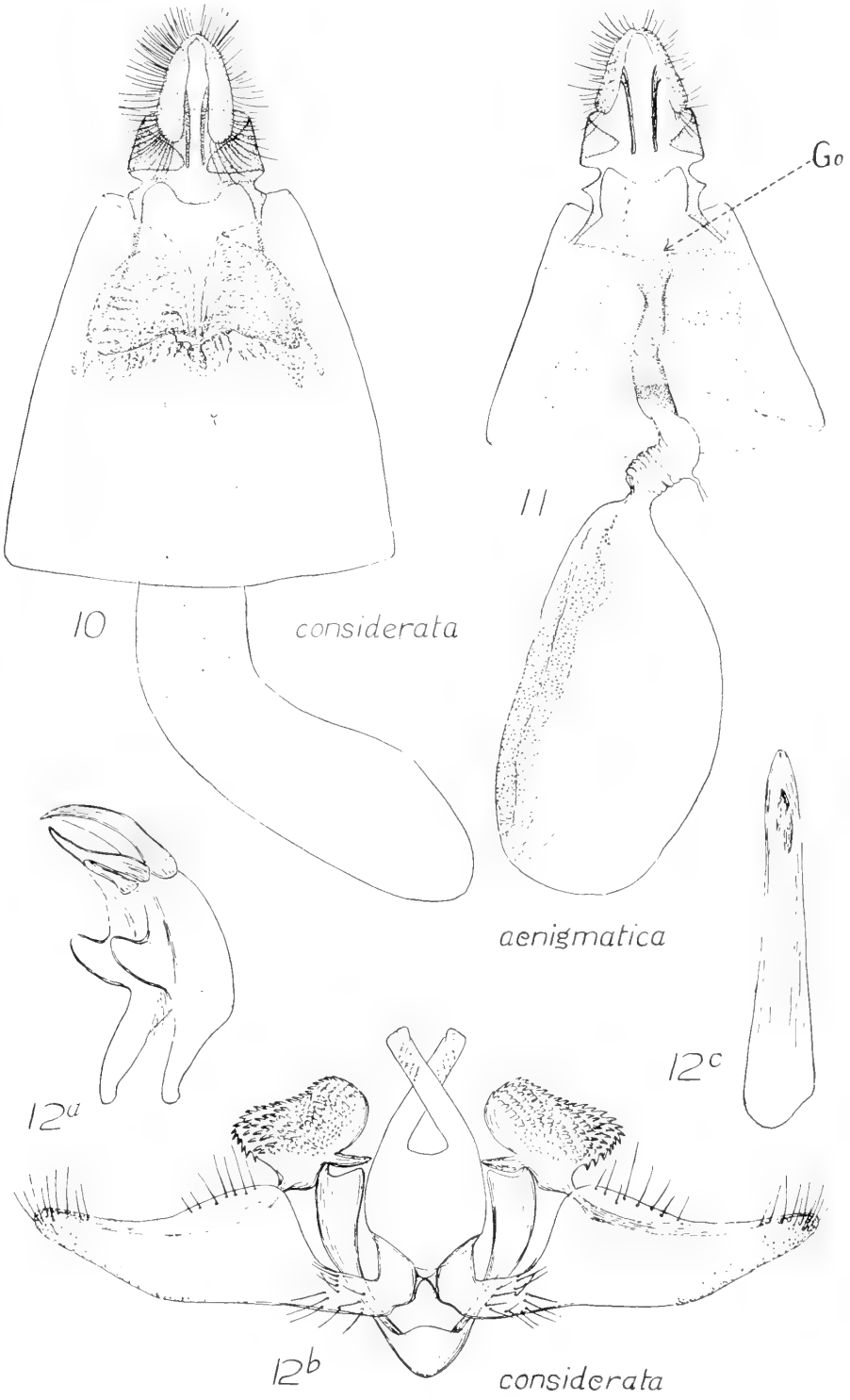
6 *barberiana*



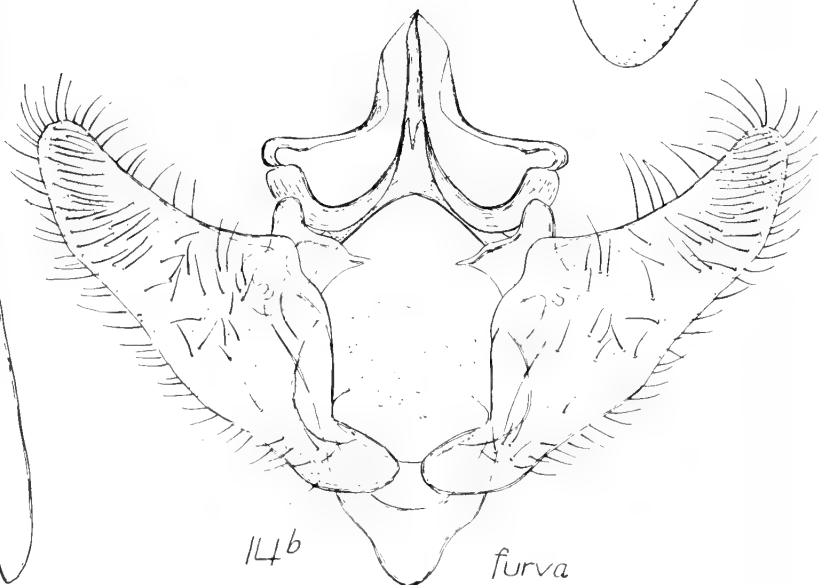
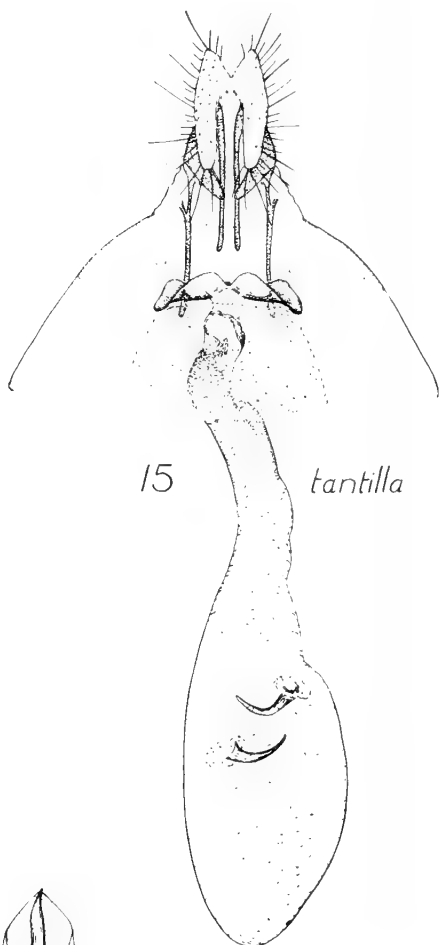
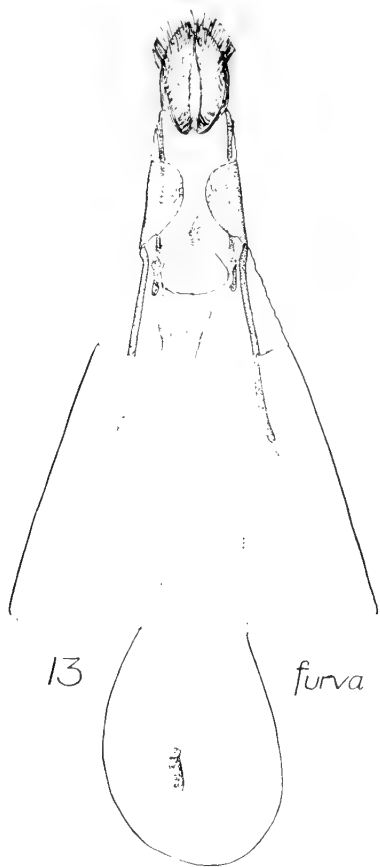
8   
cucullata



9 *cucullata*

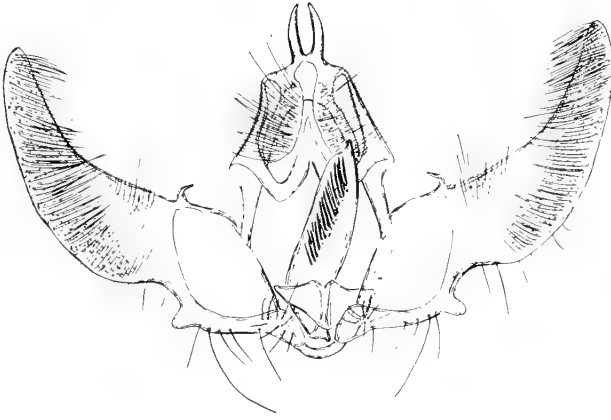


GENITALIA OF PYRALIDAE  
FOR EXPLANATION OF PLATE SEE PAGE 16.

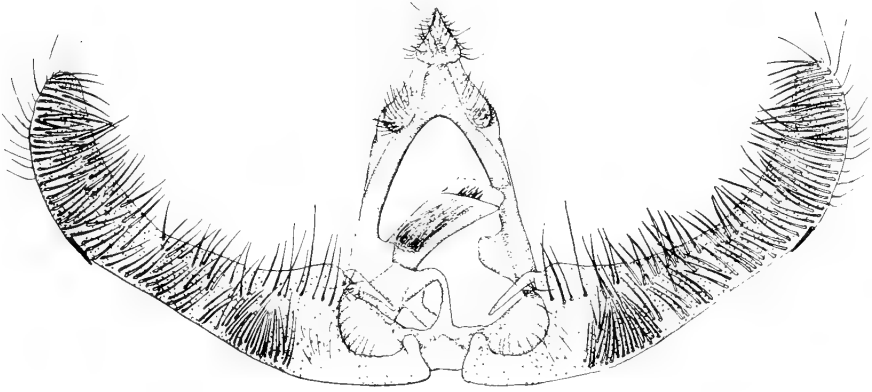


GENITALIA OF PYRALIDAE AND OLETHREJTIDAE

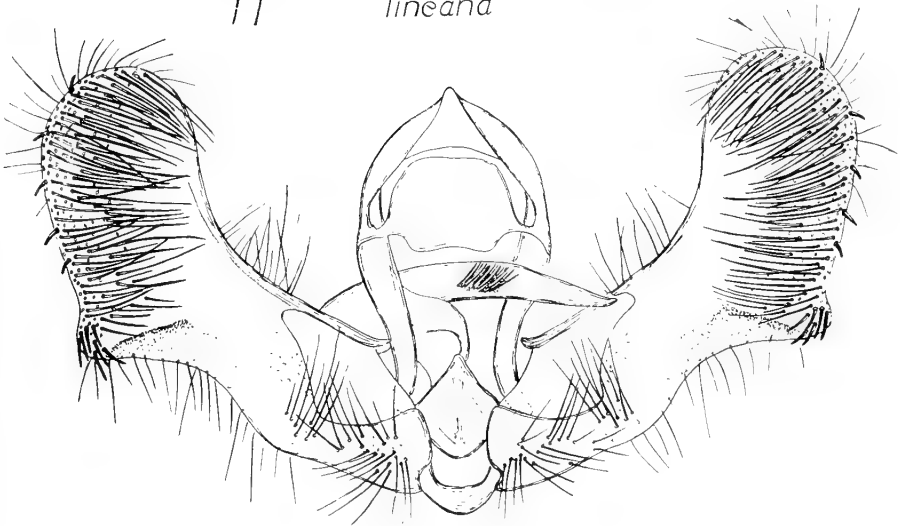
FOR EXPLANATION OF PLATE SEE PAGE 16.



16 *brauni*

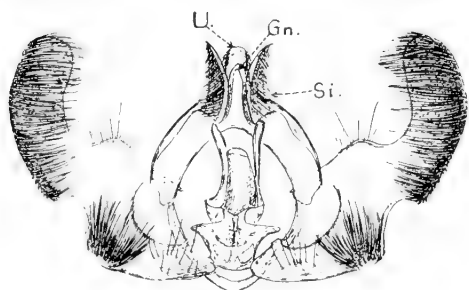


17 *lineana*



18 *desotatum*

MALE GENITALIA OF OLETHREUTIDAE  
FOR EXPLANATION OF PLATE SEE PAGE 16.



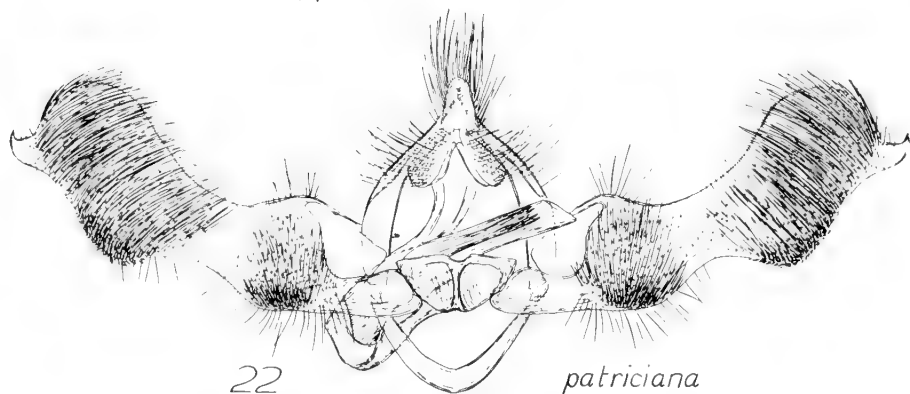
19 *lantana*



20 *accessa*



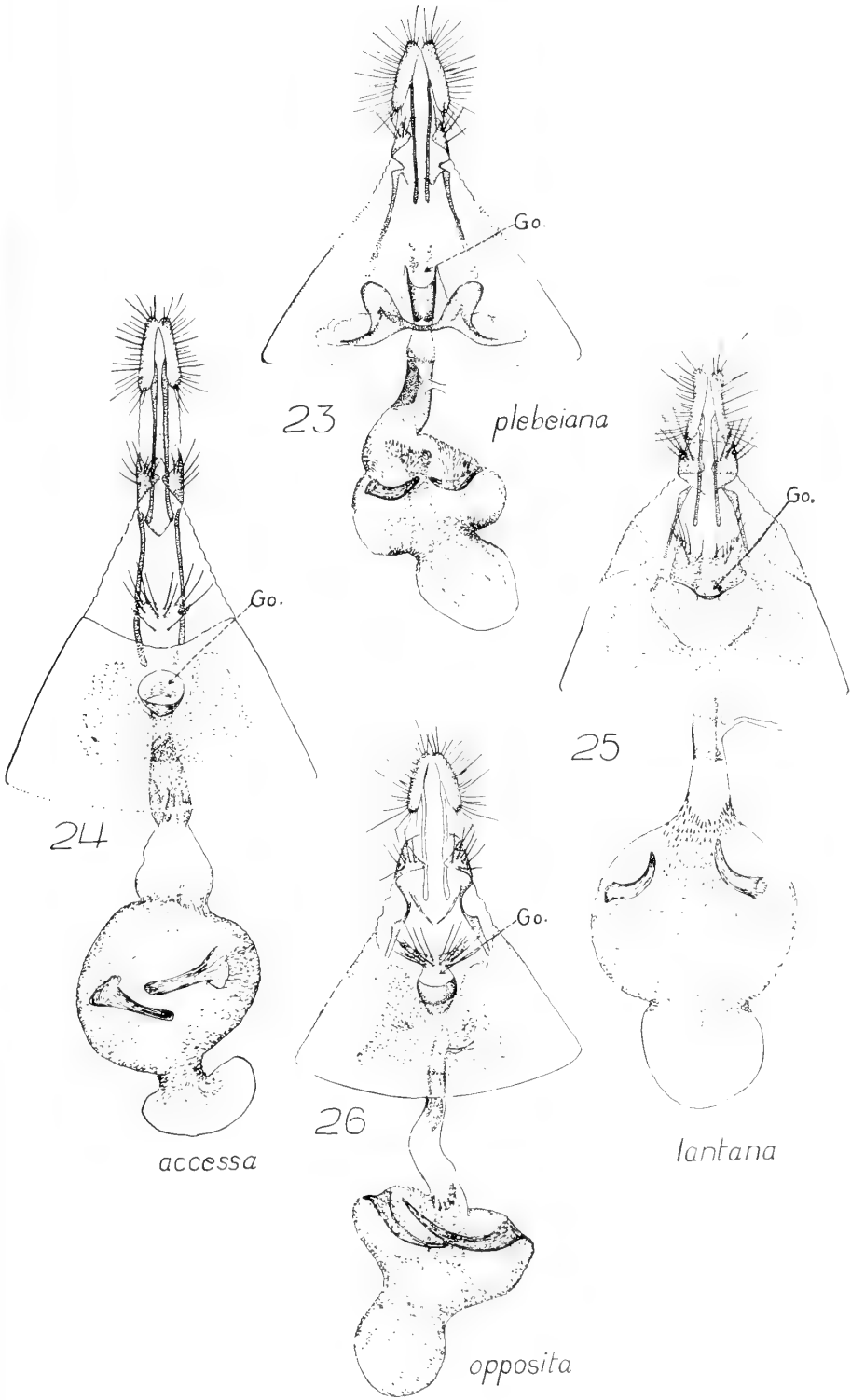
21 *opposita*



22 *patriciana*

MALE GENITALIA OF OLETHREUTIDAE

FOR EXPLANATION OF PLATE SEE PAGE 16.



MALE GENITALIA OF OLETHREUTIDAE  
FOR EXPLANATION OF PLATE SEE PAGE 16.





# DESCRIPTIONS OF THIRTEEN NEW AMERICAN AND ASIATIC ICHNEUMON-FLIES, WITH TAXONOMIC NOTES

By R. A. CUSHMAN

*Entomologist, Bureau of Entomology, United States Department of Agriculture*

This paper includes the descriptions of 13 new species of ichneumon-flies of the families Ichneumonidae and Braconidae from North and South America, China, and Korea, together with a few taxonomic notes.

## Family ICHNEUMONIDAE

### ECTOPIMORPHA LUPERINAE, new species

Similar in form to *E. anceps* (Cresson), but with the abdomen less strongly compressed and less attenuate at apex and differing in many other respects, as will appear in the following description. It may be even more closely related to *Amblyteles hiulcus* Cresson, which is unknown to me, but from the description the present species differs in having the black of tergites 3 to 5 apical instead of basal and the apex of the abdomen black instead of ferruginous.

*Female*.—Length, 12 mm. Head very minutely alutaceous, opaque, and punctate; frons transversely convex and densely punctate above, with short, shallow, polished scrobes below; temples sparsely, finely punctate, convexly convergent, length about equal to short diameter of eye; postocellar line a little longer than ocell-ocular line and nearly twice the diameter of an ocellus; eyes divergent below; face twice as broad as long, coarsely but not densely punctate, more sparsely so and more shining medially; clypeus sculptured like middle of face, barely two-thirds as broad as width of face at antennal foramina, squarely truncate at apex; labrum exposed and very broadly rounded; mouth hardly as broad as face at lower margin of eyes; malar space fully one and two-thirds times as long as basal width of mandible; antennae slender, involute, tapering at apex, apparently about two-thirds as long as body, flagellum 47-jointed (45 to 49 in female paratypes; *anceps* averages about 9 less). Thorax sculptured like the head; pronotum rather densely, finely punctate above, striate posteriorly below; mesoscutum densely, finely punctate anteriorly, less finely and densely so posteriorly, notauli faint; scutellum polished, sparsely punctate; mesopleurum and metapleurum with rather coarse, well-separated punctures, speculum very small, polished; propodeum alutaceous, punctate above, rugulose-punctate laterally, transversely

rugulose behind apical carina; areola impunctate, longer than broad, with costulae not far behind middle; spiracles slitlike, close to lateral carina. Abdomen very finely alutaceous, opaque, impunctate; postpetiole medially, and second tergite basally, faintly, longitudinally striate; gastrocoeli obsolete; compression of abdomen beginning on fourth segment; apical two tergites abruptly shorter than preceding; sheath projecting, hardly three times as long as broad.

Ferruginous; occiput medially, thoracic sutures, propleura largely, apices of hind femur and tibia and their tarsi, apical margins of tergites 2 to 5 and tergites 6 and 7 entirely, black to piceous; subalar tubercle and scutellum yellowish; antennae ferruginous, apices black; wings hyaline, faintly yellowish, stigma pale, veins black.

*Male*.—Differs from female principally as follows: Ocelli slightly larger; eyes parallel within; face narrower; malar space distinctly shorter than basal width of mandible; antennae very slender, not involute; metapleurum longitudinally rugulose below; propodeum more shining, more or less rugulose above; abdomen finely punctate beyond first tergite; gastrocoeli more distinct, transverse, at about basal fourth of tergite, with a strong carina running to base of tergite; abdomen only very faintly compressed apically, tergites gradually shorter, seventh abruptly shorter.

Head black; face and under side of antennae yellowish, frontal and lower posterior orbits reddish; thorax black, prescutum largely, lateral lobes anteriorly, and a spot in middle of mesopleurum, ferruginous; scutellum, humeral angle of pronotum, subalar tubercle, and propodeum except base, yellowish; front and middle legs testaceous, their coxae and trochanters yellow; hind coxa yellow above and at apex below, otherwise black, trochanters, base of femur, tibia except apex and tarsus reddish to yellowish, femur otherwise and apex of tibia black; abdomen paler than in female with first tergite black at base and apex.

*Host*.—*Luperina stipata* Morrison.

*Type*.—U.S.N.M. No. 42894, from Ames, Iowa.

Nine females and six males from the type locality, the type, allotype, and a paratype male reared from the type host by George Hendrickson on July 25, 1929, the others reared by G. C. Decker under Iowa Experiment Station No. 30. Also one female labeled Prince Albert, June 24, 1913.

#### Genus PHOTOCRYPTUS Viereck

*Photocryptus* VIERECK, Proc. U. S. Nat. Mus., vol. 46, p. 379, 1913.

Structurally this genus is closely allied to *Acroricnus* Ratzeburg, and rearing records show it to be biologically related as well, both being parasitic on wasps that use mud for their nests, such as *Eumenes* and *Sceliphron*.

*Photocryptus* is probably at most subgenerically distinct from *Acroricnus*, but on the basis of the few species of each genus before me they differ constantly by the following characters:

## PHOTOCRYPTUS

Nervellus broken distinctly below middle and perpendicular.

Areolet with second intercubitus nearly perpendicular, first intercubitus strongly reclivous.

Antennae in female nearly as long as body, very slender throughout.

Occiput broad, the temples correspondingly narrow.

Eyes parallel within, not emarginate.

Frons impressed medially, tumid at sides.

Vertex impressed between eyes and ocelli.

Clypeus very short and broad, malar space short.

Notauli deep and distinct nearly to scutellar fovea.

Mesopleurum less densely and somewhat more finely punctate than mesoscutum.

Propodeum with apical carina obsolete, the petiolar area coarsely, transversely rugose.

Metapleurum with a strong carina running obliquely from ventral margin to upper side of coxal cavity.

## ACRORICNUS

Nervellus broken above middle and reclivous.

Areolet with second intercubitus strongly inclivous, first intercubitus nearly perpendicular.

Antennae in female much shorter than body, distinctly thickened toward apex.

Occiput narrow, temples broader.

Eyes convergent below and weakly emarginate opposite antennae.

Frons nearly flat.

Vertex at most weakly impressed between eyes and ocelli.

Clypeus not especially short, malar space long.

Notauli much weaker posteriorly and usually fading out near middle of mesoscutum.

Mesopleurum more densely and coarsely sculptured than mesoscutum, the former more or less rugose.

Propodeum with apical carina distinct, the petiolar area at most finely rugose.

Metapleurum with only a short stub of such a carina.

## PHOTOCRYPTUS PACHYMENAE (Cresson) (new combination)

*Cryptanura* ? *pachymenae* CRESSON, Proc. Acad. Nat. Sci. Philadelphia, p. 168, 1873.

In addition to a female cotype, the National Museum collection contains seven other females and six males as follows: A female from the C. F. Baker collection from Mexico; four males from San Rafael, Jicoltepec, Mexico; one female from Carillo, Costa Rica (William Schaus); one male from San Antonio, Nicaragua; one female reared by J. Zetek from nest of *Sceliphron fistularae* on Barro Colorado Island, Panama Canal Zone; one of each sex from the same locality, reared by Phil Rau, but the host not given; one female from Cano Saddle, Gatun Lake, Panama (R. C. Shannon), May, 1923; one female from Cabima, Panama (August Busck), May 20, 1911; and one female from Kalacoon, British Guiana (P. G. Howes).

This species is very closely related to the genotype, *photomorphus* Viereck, but can be immediately distinguished by the confluence of the black markings of the frons and occiput with the resulting disappearance of the conspicuous, transverse, yellow stripe behind the ocelli. In the present species, this black marking reaches the eyes, which it does not do in *photomorphus*. The second tergite is less distinctly reddish at base and has a distinct, black band across the middle, while the black of the third tergite is more distinctly removed from the base than in *photomorphus*. In the male, the abdomen is usually without black markings, but one specimen has them. The genotype appears to be no more than a variety of *pachymenae*.

*Cryptanura* is known to me only from Brullé's description, but *pachymenae* certainly does not belong there if only for its large anteriorly convergent areolet, this cell in *Cryptanura* being small and parallel sided as in *Polycyrtus*.

PHOTOCRYPTUS ATER, new species

Very distinct from the other two species referred to the genus by its largely black color.

*Female*.—Length, 8 mm.; antennae, 7 mm.; ovipositor sheath, 4 mm. Eyes very large, in front view each occupying more than one-third the width of the head; face very slightly narrower than frons; face and clypeus minutely shagreened and sparsely, weakly punctate; clypeus slightly more than twice as broad as long; malar space nearly obliterated; pronotum smooth and polished laterally, with strong rugosities in the lower angle; mesoscutum coarsely, closely punctate, scutellum sparsely so; pleura more sparsely and more finely punctate, polished; propodeum punctate before basal carina, coarsely, transversely rugose behind; inner hind calcarium nearly twice as long as outer and nearly three-fourths as long as basitarsus; abdomen slender; first tergite with postpetiole very little broader than petiole; second nearly four times as long as broad at base.

Black with the following white markings: Face, clypeus, mouth parts, cheeks, orbits, except at top of eyes behind, scape and pedicel, propleura, pronotum anteriorly, tegulae, subalar tubercle, median spot on mesoscutum, scutellum transversely at base, upper division of metapleurum and a spot at apex of lower division, a median spot and two lateral apical spots on propodeum, front and middle legs (except a black streak on posterior face of femora, the middle tarsi, and the apical joint of front tarsus), spot on upper face of hind coxae, proximal joint of hind trochanter largely, base of tibia, second to fourth joints of hind tarsus with more or less of first and fifth, first and second tergites basally and apically and others nar-

rowly at apex; wings hyaline, with an infumate spot at apex, venation black; flagellum brownish basally.

*Male*.—Like female but the white of the orbits is somewhat less extensive, the scutellum is white only at the sides, the white markings of the mesoscutum and propodeum are absent, the hind tarsus is black with only the under side of the fourth joint and apices of the others white, and the third tergite is white at both base and apex, while the tergites beyond are entirely black.

*Type*.—U.S.N.M. No. 42895, from Barro Colorado Island, Panama Canal Zone.

One specimen of each sex reared (host not given) by Phil Rau, the female under his No. 7754 and the male under No. 7815.

**CALLIEPHIALTES NUCICOLA, new species**

*Female*.—Length, 8 mm.; antennae, 5 mm.; ovipositor, 8 mm. Head polished, sparsely punctate, punctures on face coarser, face three-fourths as long as broad, roundly elevated medially; temples convexly receding. Thorax twice as long as deep and finely punctate; propodeum sparsely, more coarsely punctate, medially and apically impunctate, without median carinae, not medially impressed; nervellus broken a little above middle, perpendicular; areolet elongate; legs rather stout, third and fifth joints of hind tarsus equal. Abdomen narrow; first and second tergites longer than broad at their junction, first distinctly shorter than second; third and fourth quadrate, others transverse; punctation rather coarse and well-separated; tubercles distinct, more sparsely punctate; ovipositor sheath slightly longer than body.

Black; palpi, tegulae, short humeral line, front trochanters, apical joint of middle trochanter, and a line on upper side of each tibia from base nearly to apex, white; hind tibia below and at apex, and apices of tarsal joints, reddish fuscous, the tarsi generally paler fuscous; legs otherwise reddish testaceous; wings hyaline, veins black, stigma brown, base and apex pale, as are also the costa and metacarpus; abdomen brownish, paler laterally toward apex, first and last tergites and apical margins of second to fifth, especially laterally, black.

*Male*.—Face nearly as broad as long; abdomen more slender, first tergite nearly as long as second; under side of scape and pedicel white; front and middle legs white except posterior side of femora; hind trochanter white, abdomen more nearly uniformly colored.

*Type host*.—*Carpocapsa pomonella* (Linnaeus).

*Type*.—U.S.N.M. No. 42896, from Saticoy, Calif.

Described from 13 females and 16 males, 8 of the females and all the males, including the type and allotype, reared by S. E. Flanders and R. E. Barrett from the codling moth in green walnuts at the

type locality; one female reared by C. T. Dodd from an acorn of California white oak (*Quercus lobata*) at Walnut Creek, Calif.; one female (Hopkins U. S. No. 15637<sup>2</sup> reared by L. H. Weld from *Quercus* sp. at Las Vegas, N. Mex.; one female (Hopkins U. S. No. 14215f) reared by J. M. Miller from the gall of *Cynips maculipennis* Gillette at Ashland, Oreg.; one female (Bureau of Entomology No. 168<sup>o</sup>) reared from *Walshia amorphella* Clemens, Alameda County, Calif.; and one female from Menlo Park, Calif., F. Hornung.

There is great variation in size, the largest female being 12 mm. long and the smallest male less than 4 mm.

**CALLIEPHIALTES BENEFACITOR, new species**

Very similar in form to *nucicola*, but differing from the description of that species as follows:

*Female*.—Length, 9 mm.; antennae, 7 mm.; ovipositor, 12 mm. Head more distinctly punctate, face rather densely so; face hardly two-thirds as long as broad; temples very narrow, convex. Thorax distinctly punctate, mesoscutum rather densely so, propodeum densely and more coarsely punctate, carinae represented by parallel ridges flanking a longitudinal groove; nervellus reclivous, broken distinctly above middle. Abdomen narrow, only second tergite distinctly longer than broad at base, first and third to fifth as broad as long, punctuation dense, tubercles rather low and hardly less densely punctate; ovipositor distinctly longer than body.

Black; scutellum piceous red; hind tibia fuscous above, pale below; hind tarsus except extreme base entirely fuscous; legs otherwise much as in *nucicola*, but dorsal stripes of middle and front tibiae less distinct; wings as in *nucicola*.

*Male*.—Face fully two-thirds as long as broad, densely punctate and with short, dense pile; abdomen only slightly more slender than in female; genitalia very long and slender.

Scape and pedicel white in front; lateral lobes of mesoscutum, subalar tubercle, and lower mesopleurum, piceous red; front and middle legs, except posterior side of femora and upper side of middle coxa, white; hind trochanter also largely white.

*Host*.—*Grapholitha molesta* Busck.

*Type*.—U.S.N.M. No. 42897, from Burlington, N. J.

Twenty-three females and 17 males, all reared from the oriental fruit moth; 14 females and 10 males from the type locality; 1 male from Hopewell, N. J.; 4 females and 3 males from Harrisburg, Pa.; 3 females and 2 males from Chambersburg, Pa.; 1 of each sex from Manchester, Pa.; and 1 female from Stewartstown, Pa.

The only striking variation is in the color of the thorax in the male. The allotype displays about the average color, some specimens having the red much brighter and embracing the entire mesosternum,

and others having the thorax entirely black except the scutellum and faint indications of red on subalar tubercles and before middle coxae. The scutellum in the female is sometimes virtually black.

Known only from New Jersey and Pennsylvania and only as a parasite of an introduced insect, this species may possibly have been introduced with its host, but I have been unable to identify it as any of the described Japanese or European species of *Ephialtes* or *Pimpla*.

**EIPHOSOMA AZTECUM Cresson**

Both Brues<sup>1</sup> and Cockerell<sup>2</sup> misplaced this species in their keys among those species with lateral black markings on the propodeum. The "spot on the flanks" of Cresson's description is on the mesopleurum, and the "lateral stripes on mesothorax" are those on the lateral lobes of the mesoscutum. In both of the above keys, a cotype of *aztecum* in the National Museum collection runs to *septentrionale* Brues, from which its polished and impunctate (except on mesoscutum) thorax and propodeum, entirely red hind femur, and longer malar space will serve to distinguish it.

**EIPHOSOMA PARAGUAIENSE, new species**

Runs in both Brues's and Cockerell's keys to the last couplet, but agrees with neither alternate. From *aztecum* Cresson, which, as pointed out elsewhere, is misplaced in both keys, it differs in having the lateral black markings on the propodeum and in the extensive black coloration of the hind femur. From *atrovittatum* Cresson it differs in its black hind tibia and tarsus; and from *forte* Cockerell, in its much smaller size and hyaline wings. From all three it differs in its lack of the areolet.

*Female*.—Length, 11 mm.; antennae, 9 mm.; ovipositor, 5 mm. Face coarsely punctate, clypeus more sparsely so, both somewhat elevated; frons transversely striate; temples shagreened; malar space barely half as long as basal width of mandible and narrower than cheek; lower portion of occipital carina and especially lower margin of mandible strongly elevated and flangelike; eyes very large and bulging slightly beyond the general contour of the head; antennae slender, basal joint of flagellum fully six times as long as thick. Thorax shining, mesoscutum, mesosternum, and lower pleurum sparsely punctate; propodeum without longitudinal carinae but strongly separated from the metapleurum, obscurely, transversely striate, more distinctly so in the broad, shallow, median impression; areolet wanting; postnervulus broken slightly above upper third; nervulus interstitial; abscissula curved, strongly oblique to metacarpella and hardly half as long as intercubitella; nervellus slightly inclivous.

<sup>1</sup> *Psyche*, vol. 18, p. 21, 1911.

<sup>2</sup> *Proc. U. S. Nat. Mus.*, vol. 46, no. 2010, p. 61, 1913.

Abdomen of normal form; second tergite distinctly longer than first, third half as long as second, fourth and fifth equal and somewhat longer than second, sixth shorter than second; ovipositor barely more than a third as long as abdomen.

Head and thorax yellow with black markings as follows: Vertex, middle of frons, upper occiput, and upper posterior orbits; antennae except scape and pedicel; a broad stripe on each lobe of mesoscutum confluent behind with the prescutellar spot, the lateral ones reaching the lateral margin of the mesoscutum; oblique impression of mesopleurum; lateral area of scutellum and its apex; postscutellum; band in basal constriction of propodeum and metapleura, and three broad stripes on propodeum confluent with basal band; a large, irregular spot nearly encircling the hind coxa at base; trochanter and trochantella largely; basal and subapical diffused bands on hind femur; hind tibia, except reddish stain below, and hind tarsus; all coxae and trochanters, except as noted, and apices of femora yellow; front and middle legs otherwise testaceous; middle of hind femur rufo-piceous; wings hyaline, apices clouded. Abdomen ferruginous with petiole stramineous and a black to piceous, median stripe extending from postpetiole to apex.

*Type*.—U.S.N.M. No. 42898, from San Bernadino, Paraguay.

One female (K. Fiebrig).

#### EIPHOSOMA SEPTENTRIONALE Brues

In the original descriptions of this species, Brues states that the palpi are 4-jointed without specifying to which palpi he refers and also that the sixth tergite is *as long* as the second. If the maxillary palpi have only four joints, this is abnormal; and it seems most probable that the statement in regard to the sixth tergite must be due to the omission of a word, such as "half" or "one-third."

#### EIPHOSOMA BATATAE, new species

In Cockerell's key <sup>3</sup> runs to couplet 5, where in size it agrees somewhat better with *septentrionale* Brues than with *mexicanum* Cresson, although the infuscation at the apices of the wings is barely discernible. In *mexicanum*, the eyes are extremely large even for the genus and bulge all around beyond the general contour of the head, which is true neither of the present species nor of *septentrionale*.

*Female*.—Length, 15 mm.; antennae, 7 mm.; ovipositor, 5.5 mm. Head shining, coarsely punctate, sides of face and clypeus more sparsely so; temples shagreened, impunctate; vertex not shagreened; middle of face and clypeus somewhat elevated; eyes large but not conspicuously bulging; malar space two-thirds as long as basal width of mandible, broader than cheek; lower end of occipital carina and

<sup>3</sup> Proc. U. S. Nat. Mus., vol. 46, no. 2010, p. 61, 1913.



margin of mandible high and flangelike; antennae slender, basal flagellar joint about six times as long as thick. Thorax shining; pronotum, scutellum, and oblique impression of mesopleurum polished; mesoscutum coarsely punctate, lower mesopleurum and sternum less distinctly punctate, metapleurum virtually impunctate; propodeum with only the two transverse carinae, separated from metapleura by carinae, medially impressed and transversely striate, laterally polished; areolet present, narrow and strongly petiolate; nervulus interstitial, base of second discoidal cell less than half as wide as apex of brachial; abscissula slightly oblique to metacarpella, about half as long as intercubitella; nervellus nearly perpendicular. Abdomen of normal slenderness, second tergite longer than first, third somewhat less than half as long as second, fourth and fifth subequal and somewhat longer than third, sixth subequal to third; ovipositor half as long as abdomen.

Head and thorax yellow with black markings as follows: Middle of frons and vertex, upper portion of occiput, and upper posterior orbits; broad stripes on three lobes of mesoscutum, the lateral ones confluent with the triangular prescutellar spot; oblique mesopleural impression; lateral portion and apex of scutellum, postscutellum, and band in constriction at base of propodeum and metapleura; median band on propodeum; spots on dorsolateral and inner faces of hind coxae, hind trochanter entirely and trochantella dorsally, femur except whitish apex and reddish band in middle, tibia except reddish stain below, and tarsi; front and middle coxae and femora pale testaceous, these legs otherwise stramineous; hind coxae and trochantella below stramineous; abdomen ferruginous; first tergite largely black, the petiole stramineous except at base and a black line on each side; other tergites more or less black on dorsal line.

*Male*.—Essentially like female.

*Host*.—Lepidopteron on sweetpotato.

*Type*.—U.S.N.M. No. 42899, from Bahia, Brazil.

Described from one specimen of each sex reared by G. Bondar.

## Family BRACONIDAE

### Genus CAPITONIUS Brullé

*Aulacodes* Cresson is synonymized in Dalla Torre's catalogue with *Cenocoelius* with which *Capitonius* is also synonymized. But Viereck, in his genotype list, questioned the synonymy of *Aulacodes* and *Capitonius*.

A series of eight females and three males undoubtedly referable to *Aulacodes nigriventris* Cresson received from the Tropical Plant Research Foundation makes certain the synonymy of *Aulacodes* with *Capitonius*.

Cresson says that his specimen had "about 24" antennal joints, while all the present series that have complete antennae have 27 joints. This is the only apparent difference between these specimens and the original description. Cresson also states that in *Capitonius* the antennae have only about half the number of joints. This is, of course, not the case, and is due to Cresson's failure to observe that Brullé stated that the antennae of his specimen were broken off at the eleventh joint.

**HELCONIDEA NECYDALIDIS, new species**

Very closely related to *frigidus* (Cresson) and possibly within the range of variation of that species, but differing from a homotype (Rohwer) of that species in the National Museum in its broader temples, broader abdomen, and shorter ovipositor.

*Female*.—Length, 10 mm. Head behind eyes as broad as at apex, the temples strongly convex, vertex and temples except medially strongly punctate; frons less deeply concave than in *frigidus*, the bounding ridges less strongly elevated just above antennae; eyes slightly divergent below; face coarsely and roughly rugose, especially medially where the ridges are subparallel and form several longitudinal grooves, the middle one of which comes to an acute point at the base of the frontal keel; malar space three-fifths as long as eye, the furrow broad and coarsely foveolate; clypeus little more than half as long as face and only about a third as long as broad; antennae about two-thirds as long as body, slender, basal joint of flagellum three times as long as thick. Pronotum very coarsely striate in impression, humeral angle polished and sparsely, finely punctate; mesoscutum polished, prescutum sparsely punctate, notauli coarsely foveolate; scutellum polished, sparsely finely punctate, fovea and lateral areas coarsely striate-foveolate; mesopleurum polished in middle and in humeral angle, the furrow between coarsely rugose, sternauli very coarsely foveolate; metapleurum very coarsely reticulate-rugose throughout; propodeum very coarsely reticulate with finer reticulations within the larger areas, medially with a more or less well-defined longitudinal area that comes to an acute angle basally; femoral tooth subacute. Abdomen polished, first tergite more or less distinctly rugose; second tergite barely as long as broad; sheath distinctly shorter than body.

Black, with legs and abdomen ferruginous; scape, clypeus, and mandibles ferruginous; palpi infuscate stramineous; tarsi paler than tibiae, hind tibia blackish, especially above; wings dilutely infumate, venation black; abdomen with venter and extreme apex black.

*Male*.—Essentially like female. Antennae fully as long as body.

*Host*.—*Necydalis laevicollis* LeConte.

*Type*.—U.S.N.M. No. 42900, from Mount Douglas, Vancouver Island, British Columbia.

Described from two females and one male received from the Provincial Museum of British Columbia and reared November 22, 1925, by G. A. Hardy. The female paratype is returned to the Provincial Museum of British Columbia.

**CHELONUS (CHELONELLA) PECTINOPHORAE, new species**

Very similar to *busseyi* Viereck, but differs constantly, so far as the available material goes, in several details of structure.

*Female*.—Length, 3 mm.; antennae, 2 mm. Head from above broadly transverse, temples strongly convex, occiput rather shallowly excavated, the arc of its curvature hardly a quarter circle; vertex behind ocelli, temples, cheeks, and sides of frons minutely striate, opaque; frons medially subopaque, weakly impressed; eyes parallel within, about three-fourths as long as width of face; face minutely granularly opaque; clypeus more shining than face, minutely punctate; malar space much longer than basal width of mandible; antennae 16-jointed, only slightly thickened beyond middle, all flagellar joints longer than thick but the subapical ones only slightly so. Thorax robust; pronotum reticulate-rugose; mesoscutum shining, finely reticulate-punctate, prescutum medially and the notauli carinate, area in front of scutellum reticulate-rugose, the longitudinal rugae very irregular and only a little stronger than transverse rugae; scutellum subpolished, more or less rugose around margins, lateral areas foveolate with a broad polished margin; metanotum in the form of a broad, foveolate groove, pleura reticulate-rugose; propodeum very coarsely reticulate-rugose above, more finely so behind, the basal middle somewhat elevated, apophyses very small; basal abscissa of radius shorter than second, strongly curved and joining the second at a distinct angle. Carapace rather narrow, nearly two and a half times as long as broad, broadest near apex, densely pilose apically, longitudinally rugose, the rugosity becoming reticulate toward apex, at middle with about 18 rugae, basal carinae strong, converging posteriorly, extending on to the horizontal surface and setting off a more finely striate basal area; ovipositor not surpassing apex of carapace, very slender.

Black with basal two-fifths of abdomen, except basal area, white; scape ferruginous; palpi pale testaceous; hind legs black, apex of coxa and trochanters pale testaceous, broad annulus on tibia and tarsal joints except apices whitish; middle legs piceous and front legs largely ferruginous with same pattern as hind leg; wings hyaline with a pale fuscous cloud below stigma, stigma and veins dark brown with basal vein, base of stigma, bases of longitudinal veins, entire submedius, and all veins in hind wing whitish.

*Male*.—Antennae nearly as long as body, slender, 24-jointed; apical incision of carapace broadly transverse, about four times

as broad as high; all veins in front wing except at base dark, in hind wing somewhat darker than in female. Otherwise like female.

*Host*.—*Pectinophora gossypiella* (Saunders).

*Type*.—U.S.N.M. No. 42901, from Mokpo, Korea.

Two females and two males reared by T. Kambe in 1928.

These are from the same source as three males that appear to differ from the allotype only in the entire or practically entire lack of white at the base of the abdomen. These are not included in the type series, although I believe they are of the same species.

In *busseyi* Viereck the occiput is more deeply impressed, with the arc of its curvature fully a quarter circle, eyes slightly convergent below; rugose area of mesoscutum with longitudinal rugae much stronger and nearly regular; scutellum rugose except narrowly in middle; carapace more coarsely, longitudinally rugose, in middle with about 16 rugae; front and middle legs darker than in *pectinophorae*, even the front femora largely piceous.

#### Genus FORNICIA Brullé

*Fornicia* BRULLÉ, Hist. Nat. Ins. Hym., vol. 4, p. 511, pl. 44, fig. 3, 1846.

*Odontofornicia* ENDERLEIN, Ent. Mitteil., vol. 1, p. 260, 1912.

*Fornicia* WILKINSON, Bull. Ent. Research, vol. 19, pp. 261-265, 1928.

*Fornicia* CUSHMAN, Philippine Journ. Sci., vol. 40, pp. 234-237, 1929.

*Odontofornicia* CUSHMAN, Philippine Journ. Sci., vol. 40, pp. 234-237, 1929.

When I wrote the paper cited above, I had not seen Wilkinson's paper in which *Odontofornicia* is synonymized, nor had I seen an American specimen of this genus, and, though I expressed some doubt of the distinctness of *Odontofornicia*, I was content to let it stand.

Before the appearance in print of my paper, however, I had become convinced that the characters employed by Enderlein for distinguishing his genus from *Fornicia* are purely specific and that the two genera are identical. The reason for this conclusion is the receipt of a specimen, with the supposed generic characters of *Odontofornicia*, captured in Costa Rica by F. Nevermann. This specimen is described below as a new species.

#### FORNICIA PILOSA, new species

*Female*.—Length, 5 mm.; antennae, 5.5 mm. Clothed with long white pile that is especially dense on temples, sides of scutellum, and metapleurum.

Face shining, with minute piliferous punctures; temples more densely punctate and pilose; vertex with few hairs; temples strongly sloping, straight; pronotum medially convex, densely punctate, and pilose, not produced at sides; mesoscutum obscurely punctate, more or less rugose in positions of the notauli, median carina low and fine; scutellum rugulose-punctate, roundly emarginate at apex; post-

scutellum spinose; mesopleurum finely punctate and pilose, posteriorly polished and glabrous; metapleurum coarsely rugose; propodeum with five well-defined basal and four apical areas, the apical slope polished on each side of median carina, otherwise coarsely reticulate-rugose; hind coxae very large, reaching three-fourths the length of the abdomen; inner calcarium reaching beyond middle of basitarsus; abdomen very coarsely reticulate-rugose, the areas more or less distinctly arranged in longitudinal rows, especially on middle of carapace, the median carina, which is very strong on the first tergite, becoming broken into a row of small reticulations on the second tergite; carapace shallowly emarginate at apex; ovipositor hardly exerted.

Black; antennae basally, labrum and mandibles apically, pale brownish; front femur apically and tibia and tarsus except apical joint brownish testaceous, as are also the middle tibia at apex and joints 2 to 3 of middle tarsus; all tibiae basally and all calcaria white; wings hyaline, more or less infumate along veins, venation blackish, stigma pale at base and apex.

*Type*.—U.S.N.M. No. 42902, from Hamburg Farm, Costa Rica.

One specimen captured by F. Nevermann, January 22, 1926.

**VIPIO CHINENSIS, new species**

In Marshall's,<sup>4</sup> Kokujew's,<sup>5</sup> and Fahringer's<sup>6</sup> keys to species of *Vipio*, this species runs to *formidabilis* Marshall, but is distinct at once by its determinately black hind femora.

*Female*.—Length, 10 mm.; antennae, 7 mm.; ovipositor, 25 mm. Head transverse, polished; temples convexly sloping; face and malar space minutely punctate, latter hardly as long as basal width of mandible; clypeus with a fringe of long black hairs at base, "mouth opening" fully a half wider than its distance from eye; mandibles with group of long black hairs at base; maxillae forming a short, thick proboscis; antennae thick, filiform, flagellum slightly compressed at base, all joints except first thicker than long, those beyond middle nearly twice as thick as long. Thorax about twice as long as deep, polished, notauli broadly impressed; metapleurum and propodeum sparsely punctate, latter with a broad median groove in which is a strong carina; metacarpus little longer than stigma; basal abscissa of radius less than half as long as first intercubitus, second intercubitus much longer than first and sinuate; nervulus interstitial; legs stout, femora and hind coxae distinctly, sparsely punctate; basal joint of hind tarsus as long as combined second and third joints, fifth hardly as long as third. Abdomen slender; first and second segments longer than broad at their intersection, third as broad as

<sup>4</sup> André: Spec. Hym. Europe-Algérie, vol. 5 bis, p. 30, 1897.

<sup>5</sup> Hor. Soc. Ent. Rossicae, vol. 32, p. 345, 1899.

<sup>6</sup> Opuscula Braconologica, Bd. 1, Lief. 2-3, p. 61, 1926.

long, others transverse; middle area of first tergite rugose-punctate, the bounding grooves obsoletely foveolate; second tergite medially roughly rugose, laterally polished with uneven punctation, gastrocoeli polished, triangular, with a carina extending posteriorly in an impression that terminates in an oval pit; third tergite broadly, arcuately emarginate apically, oblique furrows confluent near base, middle area punctate basally, surface otherwise polished, suture and furrows foveolate; fourth tergite polished with a few punctures in basal middle and with an arcuate, foveolate, transverse groove near base; other tergites polished; hypopygium extending far beyond apex.

Ferruginous; antennae, stemmaticum, maxillae, apices of joints of palpi, mesosternum, coxae, trochanters, and mid and hind femora, black; mid and hind tibiae rufous, their apices and the tarsi blackish; wings black, base of stigma yellow, hyaline streaks below stigma and along second intercubitus; tegulae ferruginous.

*Male*.—Malar space and space between "mouth opening" and eye shorter; abdomen a little broader relatively and more roughly sculptured, even the fourth tergite being more or less sculptured over most of its surface. Otherwise much like female.

*Type*.—U.S.N.M. No. 42903, from Tsinan Sung, China.

One female and three males collected June 11, 1929, by Arthur Jacot.

**ATANYCOLUS ANOCOMIDIS, new species**

Related to (*Bracon*) *Atanycolus simplex* (Cresson) but differing from that species in many respects, especially in color pattern, as will appear from the following description:

*Female*.—Length, 10 mm.; antennae, 9 mm.; ovipositor, 12 mm. Smooth and polished without sculpture except minute punctation at sides of frons and face. Head behind eyes slightly narrower than at eyes, temples apparently a little longer than short diameter of eye; frontal scrobes deep, the frons on either side distinctly swollen; eyes nearly circular, about two-thirds as long as width of face at top; clypeus transversely impressed, carina outlining its base distinct only medially; "mouth-opening" little more than half as broad as its distance from eye margin; malar space a little more than half as long as eye; scape distinctly less than half as long as thick. Thorax not at all depressed, fully as deep as broad; notauli distinct; legs moderately stout, hind femur a little more than three times as long as thick. Abdomen rather narrow; first tergite much narrower at apex than long beyond spiracles, the sides parallel, with carina from spiracle at apex running very close to margin of median triangular area, the groove outlining the median area only weakly foveolate; second tergite with embossed area distinctly narrower than half length of tergite, the defining grooves weakly foveolate, lateral

grooves weak; connate suture foveolate only medially; third tergite with only faint indications of embossed area and lateral grooves.

Ferruginous with black as follows: A large roundish spot covering middle of vertex, frons except narrow orbits, face immediately below antennae, very narrow posterior orbits, antennae, palpi, mandibles largely, maxillae, propleura, more or less of anterior lateral margin of pronotum, mesoscutum except middle of posterior margin, tegulae, most of lateral areas of scutellum and postscutellum, mesosternum, apex of metapleurum, legs, and ovipositor sheath; wings blackish, venation black; trochanters more or less piceous, apices of tarsal points more or less reddish.

*Male*.—Eyes much larger, distinctly longer than width of face, the short diameter longer than temple; malar space and distance from eye to "mouth-opening" correspondingly reduced; lateral furrows of second tergite and embossed area of third somewhat more distinct.

Head black except frontal orbits and more or less of posterior orbits; thorax black, pronotum more or less reddish laterally, scutellum at apex and laterally yellowish, the color extending on mesoscutum as far as tegulae; mesopleurum below and mesosternum more or less yellowish.

*Host*.—*Anocomis lignea* Fabricius.

*Type*.—U.S.N.M. No. 42904, from Tod Inlet, Vancouver Island, British Columbia.

Five females and two males received from the Provincial Museum of British Columbia and reared in May, 1926, by G. A. Hardy.

In some of the females, there are additional blackish stains on the thorax, especially laterally on scutellum, anteriorly on mesopleurum, and around the propodeal spiracles.

In the allotype male, the red of the posterior orbits is confined to a narrow line behind the eye; in the paratype, it extends nearly the width of the temple; in the paratype, the red of the pronotum and the yellow of the mesopleurum and sternum are much more extensive than in the allotype.

A paratype of each sex is returned to the Provincial Museum of British Columbia.

**MICROBRACON NIGRORUFUM, new species**

*Female*.—Length, 3.5 mm.; antennae, 3 mm.; ovipositor, 1.5 mm. Entire body smooth, shining, and clothed with long, whitish pubescence; head from above transverse, temples convexly sloping, a little shorter from front to back than short diameter of eye; eye nearly as long as shortest width of face; "mouth-opening" slightly broader than its distance from eye and equal to length of malar space; flagellum rather stout, tapering toward apex, all joints a little longer than thick. Thorax robust, ovate; notauli distinct in

anterior two-thirds; pubescence of mesoscutum practically confined to notauli; scutellum large, with long, sparse pubescence; wings very densely pilose; stigma a little more than a third as broad as long; radius reaching margin distinctly before apex, its first abscissa a little more than a third as long as second; second cubital cell twice as long on radius as broad at apex. First tergite distinctly longer than broad, its sides beyond spiracles parallel, median area longer than broad; second tergite broadly emarginate in middle at apex, suture deep and narrow and not foveolate; third tergite longer than second, fourth shorter, fifth still shorter, ovipositor a little shorter than abdomen.

Head, including all appendages, thorax, and legs entirely coal black; wings uniformly infumate; abdomen pale ferruginous to yellowish with blackish stains at base of median area of first tergite and in middle of apical tergites.

*Male*.—Antennae as long as body; abdomen piceous medially, pale yellowish laterally, third tergite not longer than second.

*Host*.—*Pectinophora gossypiella* (Saunders).

*Type*.—U.S.N.M. No. 42905, from Mokpo, Korea.

Two specimens of each sex reared by T. Kambe in 1928.

The female paratype is smaller than the type; the abdomen is distorted so that the tergites have not the same proportions, and it has the middle even more extensively piceous than the male.

#### MICROBRACON ISOMERA, new species

*Female*.—Of the same size and form as *nigrorufum* and agreeing with nearly all the details of structure of that species as described above, but tergites 2 to 5 are nearly all equal in length, only the third being a little longer.

In color entirely different from *nigrorufum*, being very largely pale ferruginous with the legs pale testaceous with only the tarsi more or less blackish. Top and back of head and lateral lobes of mesoscutum black; prescutum, scutellum, and lower angle of pronotum stained with piceous, wings paler toward apex.

*Male*.—Head more extensively black; only the inner orbits, lower cheeks, and malar space reddish; propodeum and pleura also somewhat stained with piceous.

*Host*.—*Pectinophora gossypiella* (Saunders).

*Type*.—U.S.N.M. No. 42906, from Mokpo, Korea.

One specimen of each sex reared by T. Kambe in 1928.

This species may be only a color phase of *nigrorufum*, but the color difference is so great that with only the material described this appears impossible.



# DESCRIPTIONS OF NEW MARINE MOLLUSKS FROM PANAMA, WITH A FIGURE OF THE GENOTYPE OF *ENGINA*

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Some time ago the United States National Museum received a sending of marine shells collected by C. D. Alleman, on Taboga Island, in the Gulf of Panama. Some of these made it necessary to subject certain other collections in the possession of the National Museum to critical examination, with the result that seven new species were discovered, which are herein described. In addition to this, thanks to the kind offices of Dr. Guy Robson, of the British Museum of Natural History, I have been able to obtain a photograph of the genotype of *Engina*, which I am here reproducing as Figure 6 of Plate 1. The genus *Eudaphne* is also here defined as new.

ANACHIS TABOGAENSIS, new species

## PLATE 1, FIGURE 1

The shell is small, elongate-ovate. The nuclear wheels are flesh-colored; the rest marbled with chestnut-brown, pale-brown, orange, and flesh-colored spots of irregular size and spacing. The inside of the outer lip, except the denticles, is for the most part bright, dark rust brown; the denticles immediately behind its edge are yellowish white. Nuclear whorls 3.6, well rounded, smooth, and separated by a moderately impressed suture forming a rather conspicuous apex. The postnuclear whorls are crossed by low, rather strong, slightly protractively slanting axial ribs, of which 16 occur upon the first and second, 18 upon the third, 20 upon the fourth and the last turn. The spaces separating these axial ribs are less than half the width of the ribs. In addition to the axial ribs the whorls are marked by threadlike incremental lines, which are not closely crowded and which are present on the ribs and intercostal spaces. The spiral sculpture between the summit and the periphery consists of four equal and equally spaced incised spiral lines, which pass over the ribs and intercostal spaces and render the spaces between them on the ribs weakly tuberculated. Periphery well rounded. Base well

rounded, marked by the continuation of the axial ribs, which extend to the columella and five equal and equally spaced incised spiral lines, which equal those of the spire in strength but are a little more closely spaced than those. The ribs here as on the spire are rendered weakly tuberculated by the incised spiral lines. Columella about as long as the base, very stout, marked by seven equal strongly incised spiral lines, which make the spaces between them appear as equal, low cords. Aperture irregularly lunate, decidedly channeled anteriorly and slightly so posteriorly. Outer lip decidedly thickened immediately behind the edge, bearing eight teeth on the inside. The posterior of these teeth is more than double the width of the next three, which are subequal. The four anterior teeth are crowded on the basal fourth of the outer lip; they are also of equal size, and less than one-fourth the size of those posterior to them. The inner lip is reflected as a thick callus over the columella. The parietal wall on its anterior half is covered with a thin callus, while on its posterior half it bears a thick lumplike callus, which joins it to the outer lip at the posterior angle of the aperture.

*Type*.—U.S.N.M. No. 368143, collected by C. D. Alleman on Taboga Island, Panama. It has almost eight whorls, and measures: Length, 7 mm.; diameter, 3.3 mm. U.S.N.M. No. 368166 contains 25 topotypes.

**ANACHIS DALLI, new species**

PLATE 1, FIGURE 2

The shell is small, ovate, and pale yellowish, with an interrupted zone of large chestnut-colored spots immediately above the periphery and a second zone of interrupted spots of the same color halfway between the last and the tip of the base. There is also a zone of white, which girdles the whorls immediately posterior to the dark zone on the spire. This light zone occupies about two-thirds of the space between the dark zone of spots and the summit. Interior of aperture of the same color as the outside. Nuclear whorls 3, strongly rounded, separated by a moderately impressed suture, smooth, forming a small pointed apex. Postnuclear whorls moderately well rounded, narrowly shouldered at the summit, crossed by very slightly protractively slanting axial ribs, of which 16 occur upon all the whorls. The spaces separating the axial ribs are about as wide as the ribs and are crossed by fine, closely spaced incremental lines. The spiral sculpture consists of moderately strongly incised spiral lines, of which the first marks the posterior limit of the white spiral band. This incised line is a little stronger than the rest and passing over the ribs gives them a beadlike effect at the summit. The second incised spiral line is a little anterior to the posterior edge of the dark zone, which is crossed by two more

incised spiral lines. The fourth and last incised spiral line on the spire marks the anterior termination of the dark spots. In addition to these incised spiral lines, the entire spire and base are marked by microscopic, closely spaced, incised spiral lines, which, in combination with the incremental lines, lend to the outer surface a very fine clothlike sculpture. Periphery well rounded. Base short, well-rounded, marked by the continuation of the axial ribs and six equal and equally spaced incised spiral lines, which equal those of the spire in strength. Columella short, stout, marked by 10 spiral cords, which grow successively weaker from the posterior anteriorly, the last two at the tip of the columella being mere threads. Aperture sublunate, decidedly channeled anteriorly and feebly so at the posterior angle. Outer lip becoming much thickened immediately within the edge, provided with eight teeth on the inside, which grow progressively weaker from the posterior anteriorly. Inner lip forming a thick callus that is reflected over the columella. Parietal wall also covered by a thick callus, which joins the outer lip at the posterior angle of its aperture.

*Type*.—U.S.N.M. No. 368144, collected by C. D. Alleman on Taboga Island, Panama. It has 8 whorls and measures: Length, 6 mm.; diameter, 3 mm. U.S.N.M. No. 368167 contains 4 topotypes from the same source, while U.S.N.M. No. 331819 contains a single specimen collected by Dr. James Zetek on the same island. This was previously misidentified as *Anachis pygmaea* Sowerby. It bears collector's number 541.

#### EUDAPHNE, new genus

##### PLATE 1, FIGURE 3

The shell is very elongate-ovate and small. The nuclear whorls with sinusigerid sculpture. The early postnuclear whorls with strong axial riblets and strong spiral lirations, the junction of which produces a nodulose sculpture. On the last turn the axial riblets disappear or become obsolete, leaving the spiral sculpture only. The sinus is immediately below the suture and is moderately deep and broad. Inner lip and the inner portion of the parietal wall covered by a thin smooth callus. Operculum unknown.

*Type species*.—*Eudaphne allemani* Bartsch.

*Range*.—This group ranges from California to Panama.

#### EUDAPHNE ALLEMANI, new species

##### PLATE 1, FIGURE 3

The shell is small, very elongate-conic, and pale brown blotched and variegated with yellowish white. Of the nuclear whorls two and one-third remain in the type showing a sinusigerid sculpture,

which passes abruptly into the postnuclear sculpture without intermediate stages. The postnuclear whorls are marked by slightly protractively slanting, rather broad axial ribs, which are strongest on the early turns and which become enfeebled on the later and are quite obsolete on the last whorl. Of these ribs 11 occur upon the first postnuclear turn, 12 upon the second, 14 upon the third, 18 upon the fourth, while upon the next they are quite poorly expressed and irregular. In addition to the strong axial ribs, the entire surface of the whorls on spire and base is marked by numerous fine axial threads. The spiral sculpture also presents considerable variation. On the first whorl there are two strong spiral cords, one on the middle of the whorl, the other near the periphery. These cords are almost keels and render their junction with the axial ribs decidedly tuberculated. On the second turn two slender spiral threads appear between the summit and the first cord, and a third is present between the two strong cords. These threads become much more strongly developed upon the next whorl. On the fourth turn the strong keels are decidedly reduced almost equal to the rest of the spiral cords, of which 12 are here present between summit and suture. These are not all of the same strength, the intercalated threads being a little weaker than the rest. The fifth whorl shows 15 spiral threads, while on the last 23 are present between the summit and the periphery. Here they are subequal and subequally spaced, the spaces separating them being about equal to the spiral threads. Suture moderately constricted. Periphery well rounded. Base gently rounded, marked by 25 spiral threads, which are alternately strong and feeble. Columella moderately short, marked by 14 very oblique spiral threads. Aperture elongate-ovate, decidedly channeled anteriorly with a moderately broad and moderately deep sinus immediately below the summit on the outer lip; outer lip evenly curved, moderately thin at the edge, which is rendered finely denticulate by the spiral threads on the outside; inner lip and parietal wall marked by a slightly impressed smooth area, resembling a callus.

*Type*.—U.S.N.M. No. 368134, collected by C. D. Alleman on Taboga Island, Panama. It measures: Length, 12.8 mm.; diameter, 4.5 mm.

*Remarks*.—*Daphnella clathrata* Gabb appears to belong here, also an undescribed species from the Gulf of California.

MITRA (SCABRICOLA) MARSHALLI, new species

PLATE 1, FIGURE 4

The shell is rather small, elongate-ovate, and dark chestnut-brown. The early whorls badly eroded in the type. Those remaining subtabulatedly shouldered at the summit; the rest only very slightly curved. The whorls are marked by rather strong, almost

vertical, axial ribs, of which 13 are present on each of the last two turns. They are almost as broad as the spaces that separate them. In addition to these ribs numerous, very closely spaced incremental lines are present, which appear like slender axial threads. In addition to the axial sculptures the whorls are marked by strongly incised spiral lines, of which four occur between the summit and the suture. The first two near the summit are a little more distantly spaced than the next two. The spaces between these incised lines appear as moderately elevated cords, and their junctions with the axial ribs form low, well-rounded nodules, the first set of which is at the angle of the shoulder at the summit, which it renders feebly crenulated. Periphery well rounded. Base marked by the continuation of the axial ribs, which become somewhat enfeebled anteriorly, and six incised spiral lines, which are consecutively a little more closely spaced from the posterior to the anterior part of the base. The spaces between these incised lines also form low cords, and their junction with the axial ribs likewise produces well-rounded tubercles. The columella is short and is marked by eight closely approximated moderately strong, low spiral cords. The axial ribs scarcely extend upon the columella. Aperture elongate, decidedly channeled anteriorly, outer lip rather thick, rendered wavy by the spiral cords. The inner lip forms a moderately thick callus, which is reflected over half of the columella and also extends over the parietal wall. The inner lip is provided with three rather strong obliquely slanting folds, of which the posterior is the strongest, and the other two consecutively a little weaker.

*Type*.—U.S.N.M. No. 368135, collected by C. D. Alleman on Taboga Island, Panama. It has six whorls remaining, and measures: Length, 14.3 mm.; diameter, 6 mm.

*Remarks*.—There are several more species in our collection from the west coast belonging to this section of *Mitra*, but they appear to be all undescribed. It is possible that *Mitra solitaria* C. B. Adams may belong in this group. The present form seems to differ from that in having fewer axial ribs.

RISSOINA ALLEMANI, new species

PLATE 1, FIGURE 5

The shell is rather large. The early whorls are decollated in the type. The first of the remaining postnuclear whorls is angulated halfway between the summit and suture. This angulation is less conspicuous on the next turn and disappears entirely on the following and succeeding whorls, which are quite well rounded. The first and second turns are appressed at the summit, while the succeeding turns are feebly shouldered, the shoulder there being rendered crenu-

lated by the ribs. On the first and second of the remaining turns strong, distantly spaced, decidedly retractively slanting axial ribs are present. On the following turns these ribs become sigmoid, a little less strongly developed, and much more closely approximated. The intercostal spaces on the first and second turns are broad, and are marked by two spiral cords a little stronger than the rest at the angulation. The shoulder between this angulation and the summit on the first and second turn is crossed by about 10 slender spiral threads, while the space between the suture and the strong thread anterior to it at the angulation is marked by 5 spiral threads, which are considerably stronger than those on the summit. On the three remaining turns the stronger threads corresponding to the angulation in the middle of the turn become reduced, and only equal those anterior to it in strength. There are 10 of these subequal threads present, while the 10 slender threads on the posterior portion of the turn remain feeble. On the next postnuclear whorl this differentiation of spiral sculpture almost disappears, and we find 14 equal and almost equally spaced, rather strong spiral threads and a few feeble incised lines near the summit present between the summit and suture. On the last whorl 16 subequal and subequally spaced spiral threads are present between periphery and summit. Here the deeply impressed pits between the ribs and the spiral threads show finely incised spiral lines. Base slightly produced, marked by a continuation of the axial ribs, which become evanescent on the anterior portion of the base, and by 13 strong spiral threads, of which those on the posterior portion of the short columella are a little heavier than those posterior to it. Anterior to these strong threads there is a series of six spiral threads that are much finer and much more closely approximated than those posterior to it. These are closely crowded at the extreme anterior tip of the columella. Aperture rather large, auriculate; the sinus at the posterior angle very pronounced, less channeled anteriorly. Outer lip abruptly expanded, very much thickened and separated by a varix a little posterior to its edge. The inner edge of the callus becomes somewhat attenuated near the posterior angle, and the attenuation is sufficiently abrupt to give it a somewhat toothed aspect. The columella is reflected as a moderately broad callus and the parietal wall is covered by a strong thick callus which joins the outer lip at the posterior angle.

*Type*.—U.S.N.M. No. 368132, collected by C. D. Alleman on Taboga Island, Panama. It has 5.1 whorls remaining, and measures: Length, 7.4 mm.; diameter, 3.2 mm.

*Remarks*.—The species, while suggesting *Rissoina zeltneri* De Folin, which also comes from Panama, is nevertheless quite different in sculpture and in general form and the shape of the early whorls, and the strong sculpture differentiates it from all other species.

Genus *ENGINA* Gray

## PLATE 1, FIGURE 6

The genus *Engina* was defined by Gray in the Zoology of Beechey's Voyage (1839, pp. 112–113). Two species were mentioned here, both cited as coming from the Atlantic Ocean. The first of these, *Engina zonata*, was later designated as type by Gray. Since there seems to have been some confusion about the group, I take pleasure in publishing a photograph of the type species obtained from the British Museum of Natural History, where it is resting, which has been made available to me through the courtesy of Doctor Robson. This figure is reproduced on Plate 1, Figure 6. The specimen measures 27.5 mm. in length.

There are several species of *Engina* from the Panama region, which appear to be undefined. I shall therefore give descriptions and figures of some of these below.

*ENGINA PANAMENSIS*, new species

## PLATE 1, FIGURE 7

The shell is of medium size. The nuclear whorls are white, the rest of the shell marbled with dark chestnut-brown, yellowish white, and orange. Interior of aperture bluish white. Nuclear whorls 2.6, strongly rounded, smooth, separated by a moderately impressed suture, forming a moderately elevated apex. The postnuclear whorls are appressed at the summit, leaving the suture inconspicuous, and are marked by broad, low, rounded axial ribs, of which 11 occur upon all the turns. These ribs are crossed by numerous rough incremental lines. The spiral sculpture consists of three strong cords, which are equal on the first whorls and which render the axial ribs decidedly nodulose at their junction. Beginning with the second whorl, the spiral cord at the summit becomes enfeebled and the two anterior to it much increased in strength. On the succeeding turn a third spiral cord appears posterior to the suture, which is almost as strong as the two preceding it, the posterior spiral cord near the summit practically disappearing. These strong spiral cords render the ribs decidedly nodulose, the nodules having their long axis parallel with the spiral sculpture. In addition to the strong cords the entire surface of the shell, on spire and base, is marked by rather strong, more or less irregularly developed spiral threads, which are a little heavier than the incremental lines, the two forming a reticulated pattern. Periphery rendered somewhat angulated by the third spiral cord. Base moderately rounded, between the insertion of the columella and the periphery, marked by three almost equal and equally spaced spiral cords, which are almost as strong as the anterior one

posterior to the periphery. These spiral cords are most conspicuous on the ribs, which they likewise render nodulose. The spaces between the spiral cords are a little more than twice as wide as the cords, and are marked by moderately strong spiral threads, of which five are present between all the spiral cords. The columella is short and thick and is marked posteriorly by the feeble continuation of the axial ribs and two moderately strong spiral cords and the finer spiral threads between them. The anterior three-fourths of the columella is marked by 10 closely approximated, rather coarse, low, rounded spiral threads. Aperture narrow, decidedly channeled anteriorly, weakly so posteriorly. The outer lip is thickened immediately behind the edge, bearing on the inside a strong oblique fold a little below the posterior angle of the aperture. Anterior to this are two quite strong and closely approximated and partly fused denticles, and anterior to these are two small denticles followed by a larger one at the beginning of the anterior sinus. The inner lip consists of a thick callus which is reflected over the columella and the parietal wall, which forms a deep oblique fold opposite the posterior fold of the outer lip. Twelve short oblique denticles, which become consecutively a little wider from the posterior anteriorly, are also present anterior to this deep fold, the most anterior one being about opposite the anterior thread on the outer lip. The large fold on the parietal callus and that on the posterior part of the outer lip extend strongly inward and form a decided constriction of the posterior portion of the aperture.

*Type*.—U.S.N.M. No. 381885, from Panama. It has the last nuclear whorl remaining and 6.8 postnuclear whorls, and measures: Length, 19.6 mm., diameter, 17 mm.

*Remarks*.—In addition to the type, U.S.N.M. No. 32159 contains two specimens collected by Bridges at Panama; U.S.N.M. No. 32168 has four additional specimens obtained by the same collector in the same place; and U.S.N.M. No. 3757b contains the young specimen that has furnished us with the description of the nucleus, also from Panama.

ENGINA TABOGAENSIS, new species

PLATE 1, FIGURE 8

The shell is small. The nuclear whorls are white. The ground color of the postnuclear whorls is yellowish; first row of tubercles near the summit dark chestnut-brown, the rest very dark brown. Occasionally there are spots of flesh color on the sides of the dark tubercles. The aperture is yellowish. Nuclear whorls 2.8, strongly rounded, smooth, forming an almost mucronate apex. The postnuclear whorls



are marked by strong axial ribs, which are most strongly developed at the periphery and which diminish in strength both anteriorly and posteriorly. Of these ribs 11 are present on all the turns. The first and second postnuclear whorls are marked by three spiral cords, which are almost equal in strength, on the third and fourth turns the anterior of these three cords becomes much emphasized and the posterior one enfeebled. On the last whorl a fourth cord is apparent. The three at the periphery form strong humps. In addition to these strong spiral cords, the entire surface of spire and base is marked by finer spiral threads, of which eight are present between the summit and the second spiral cord; three are present on the second spiral cord, and two in the space between the second and third; there is one strong thread on the third spiral cord and three fine threads between the third and fourth; the fourth also has a strong spiral thread on its summit. The base is short, moderately well rounded and marked by a continuation of the axial ribs and three strong spiral cords almost as strong as the anterior one of the spire. The space between the suprapерipheral and infraperipheral cord is crossed by five spiral threads, while the space between the first and second basal cord is also crossed by five spiral threads; the space between the second and third basal cords is marked by three spiral threads. The columella is short and thick and is marked on the posterior half by three strong spiral cords a little less in strength than those on the base, but in continuation of that series. Three spiral threads are present between the stronger cords on the posterior half of the columella. The anterior half of the columella is marked by eight closely approximated slender spiral cords. The incremental lines and the spiral threads on spire and base render the general surface slightly reticulated. Aperture of irregular outline, strongly channeled anteriorly, feebly so posteriorly. Outer lip slender at the edge, reenforced within immediately behind the edge, bearing a strong oblique fold near the posterior angle and a little anterior to this two approximated denticles, which are partly fused. Anterior to these there are two smaller denticles, and a heavy denticle marks the posterior termination of the canal at the anterior portion of the aperture. The inner lip is reflected over the columella as a thick callus, which also extends over the parietal wall. This callus bears two slender threads near the posterior angle, followed by an elongate thread much heavier than these two, which faces the heavy thread at the posterior angle on the outer lip and constricts this part of the aperture almost into a canal; anterior to this fold are five slender oblique threads equaling the posterior two in strength, while on the columellar wall eight slender, rounded denticles are present.

*Type*.—U.S.N.M. No. 368154, collected by C. D. Alleman on Taboga Island, Panama. It has 2.8 nuclear whorls and 5.8 postnuclear whorls, and measures: Length, 12.3 mm.; diameter, 7.8 mm.

*Remarks*.—This species differs from *Engina panamensis* by its much smaller size, its coloration, and the denticulation of the aperture. U.S.N.M. No. 368153 contains 11 topotypes collected by C. D. Alleman, while U.S.N.M. No. 204082 contains a specimen collected by the United States Bureau of Fisheries Steamer *Albatross* at Taboquilla Island, Bay of Panama.



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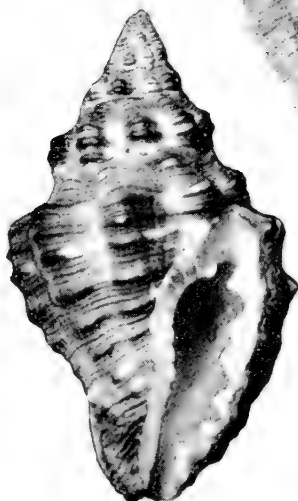
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8

## PANAMA MARINE MOLLUSKS

1. *Anachis tabogaensis*, new species; 2. *A. dalli*, new species; 3. *Eudaphne allemani*, new genus and species; 4, *Mitra* (*Scabricola*) *marshalli*, new species; 5, *Rissoia allemani*, new species; 6, genotype of *Engina* Gray from the British Museum of Natural History; 7, *Engina panamensis*, new species; 8. *E. tabogaensis*, new species.



# DESCRIPTIONS OF A NEW GENUS AND EIGHT NEW SPECIES OF ICHNEUMON-FLIES, WITH TAXONOMIC NOTES <sup>1</sup>

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Descriptions of one new genus and eight new species of ichneumon-flies of the family Braconidae are contained in this paper and, in addition, notes on the classification of several previously described but poorly understood braconid genera. Certain synonymical notes are also included.

For the opportunity of examining some of the genotypes discussed, I am indebted to Dr. H. Bischoff, of the Berlin Zoological Museum; Dr. Erno Csiki, of the Hungarian National Museum, at Budapest; Dr. H. Wachs, of the Pommeranian Museum of Natural History, at Settin, Germany; Dr. James Waterston, of the British Museum of Natural History; and Prof. E. B. Poulton, of the Hope Museum, at Oxford, England.

## Family BRACONIDAE

### Subfamily MICROGASTERINAE

#### Genus MICROGASTER Latreille

*Microgaster* LATREILLE, Hist. Nat. Crust. Ins., vol. 13, p. 189, 1805. (Genotype, *Ichneumon deprimator* Fabricius.)

*Xanthomicrogaster* CAMERON, Timbri Journ. Roy. Agr. Com. Soc. British Guiana, vol. 1, p. 325, 1911. [Genotype, *Xanthomicrogaster fortipes* Cameron (new synonymy).]

#### MICROGASTER FORTIPES (Cameron) (new combination)

*Xanthomicrogaster fortipes* CAMERON, Timbri Journ. Roy. Agr. Com. Soc. British Guiana, vol. 1, p. 325, 1911.

The genotype of *Xanthomicrogaster*, *X. fortipes*, which is in the British Museum, is a typical *Microgaster* except in having the second

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<sup>1</sup>This paper is a contribution from the Gipsy Moth Laboratory of the Bureau of Entomology, Melrose Highlands, Mass.

cubital cell smaller than usual and the second intercubitus joining the first intercubitus at about the middle. A similar small second cubital cell is found in some other species of *Microgaster*; among our North American species it occurs in *M. zonaria* (Say) and *M. edytolophae* Muesebeck.

#### Genus MICROPLITIS Foerster

*Microplitis* FOERSTER, Verh. Naturh. Ver. Preuss. Rheinl., vol. 19, p. 245, 1862.  
(Genotype, *Microgaster sordipes* Nees.)

*Dapsilotoma* CAMERON, Journ. Bombay Nat. Hist. Soc., vol. 17, p. 101, 1906.  
[Genotype, *Dapsilotoma testaceipes* Cameron (new synonymy).]

#### MICROPLITIS TESTACEIPES (Cameron) (new combination)

*Dapsilotoma testaceipes* CAMERON, Journ. Bombay Nat. Hist. Soc., vol. 17, p. 101, 1906.

This species, which is the genotype of *Dapsilotoma*, is a perfectly normal *Microplitis*. The antennae of the type, which is in the British Museum, are 18-segmented, not 36-segmented, as noted by Cameron.

#### Genus APANTELES Foerster

*Apanteles* FOERSTER, Verh. Naturh. Ver. Preuss. Rheinl., vol. 19, p. 245, 1862.  
(Genotype, *Microgaster obscurus* Nees.)

*Xestapanteles* CAMERON, Zeitschr. Natur. Halle, vol. 81, p. 447, 1909. [Genotype, *Xestapanteles latiannulatus* Cameron (new synonymy).]

#### APANTELES LATIANNULATUS (Cameron) (new combination)

*Xestapanteles latiannulatus* CAMERON, Zeitschr. Natur. Halle, vol. 81, p. 447, 1909.

I have examined Cameron's two original specimens of *Xestapanteles latiannulatus*, which are in the collection of the Berlin Zoological Museum. The species unquestionably belongs to *Apanteles*, as this genus was defined in my revision of the Nearctic species.<sup>2</sup> It is not clear how Cameron could have described the antennae as 31-segmented, for, like those of all other species of *Apanteles*, they are 18-segmented.

#### APANTELES PARALECHIAE, new species

Most similar to *polychrosidis* Viereck, but readily distinguished from that species by the slenderer thorax, by the mesoscutum being evenly distinctly punctate and opaque, by the shorter and subequal spurs of the posterior tibiae, and by the generally smaller size.

*Female*.—Length, about 1.8 mm. Head strongly transverse, at least as wide as mesonotum; face practically smooth; antennae

<sup>2</sup> Proc. U. S. Nat. Mus., vol. 58, p. 485, 1920.

slender, about as long as the body. Thorax slender; mesoscutum narrowing gradually anteriorly, opaque, and entirely evenly punctate, the punctures not confluent; scutellum flat, polished, with a few weak punctures; propodeum mostly smooth and shining, with some weak sculpture medially adjoining the shallowly impressed, imperfectly defined areola; mesopleura mostly polished, weakly punctate anteriorly; metapleura polished; anterior wing with metacarpus distinctly longer than stigma; stigma rather broad; radius not oblique, a little longer than intercubitus, not strongly angled with the latter; posterior coxae smooth; inner spur of posterior tibia scarcely longer than the outer and much less than half as long as metatarsus. Abdomen narrow; chitinized plate of first tergite parallel-sided, the base and apex of practically equal width, the entire plate very finely rugulose and opaque, and with a poorly defined median longitudinal impression posteriorly; second tergite transverse, much shorter than third, the finely rugulose plate broader at apex than at base and defined laterally by oblique impressed lines; membranous margins on apical half of first tergite and along the second, broad; following tergites practically smooth, at least the third subopaque; hypopygium large but not surpassing apex of last tergite; ovipositor sheaths slender, about as long as the abdomen, slightly decurved at apex. Black; tegulae pale; wing bases black; wings hyaline, stigma and veins pale brown; legs blackish, anterior pair beyond coxae mostly yellowish brown; middle femora sometimes pale brownish, their tibiae at base and their tarsi pale; posterior tibiae pale on basal fourth or third; lateral membranous margins of first and second tergites yellowish brown.

*Male*.—Essentially like the female, except for blackish tegulae.

In the paratypes the tegulae vary from yellow to blackish.

*Type*.—U.S.N.M. No. 42870, from Billerica, Mass.

*Host*.—*Paralechia pinifoliella* Chambers.

Described from five females and three males reared by J. V. Schaffner, jr., July 5 to August 4, 1927, under Gipsy Moth Laboratory No. 12164 N37.

APANTELES DEPRESSARIAE, new species

Very closely resembling *aristoteliae* Viereck, from which it especially differs in the weaker sculpturing of the second abdominal tergite, the less sharply defined propodeal areola, the usually relatively broader abdomen, the slightly shorter ovipositor sheaths, and, in the case of the males, the pale stigma.

*Female*.—Length, 2.5 mm. Head strongly transverse, narrower than thorax; face finely, closely punctate; antennae distinctly shorter than the body, the five apical segments conspicuously shortened although still longer than broad. Thorax stout; mesoscutum closely,

finely, in part confluent, punctate; scutellum a little longer than broad, slightly convex, smooth and shining, with only a few weak punctures; propodeum short, strongly declivous, closely rugulose and with a median areola that is rather poorly defined; radius of anterior wing longer than intercubitus: posterior coxae smooth and shining; inner spur of posterior tibia half as long as metatarsus. Abdomen short and rather stout; chitinized plate of first tergite large, the base and apex of about equal width, the sides of the plate bulging somewhat, the surface closely, finely rugulose and provided with a shallowly impressed longitudinal median area posteriorly; second tergite very short, strongly transverse, the posterior margin slightly arcuate, the surface of the plate very minutely granular; following tergites smooth and shining; hypopygium large, slightly surpassing apex of last tergite; ovipositor sheaths about three-fourths as long as the abdomen. Black; anterior femora except at base, anterior and middle tibiae and tarsi, and the posterior tibiae except at apex, yellow; tegulae black; wings hyaline, stigma brown, the veins pale, almost hyaline.

*Male*.—Legs even darker than in female; wings whitish hyaline; stigma hyaline except the margin, which is brown; veins colorless.

*Type*.—U.S.N.M. No. 42871, from Kenduskeag, Me.

*Host*.—*Depressaria heracliana* De Geer.

*Cocoons*.—White, elongate-cylindrical, solitary.

Seven females and seven males reared July 22 and 23, 1926, by J. V. Schaffner, jr., under Gipsy Moth Laboratory No. 12430 M2. There is additional material of this species at the Gipsy Moth Laboratory, all reared from the same host as the type series, from Manchester and Castleton, Vt.; Bangor, Me.; and Dover, Mass.

APANTELES SCHAFFNERI, new species

In my key to the North American species of *Apanteles*<sup>3</sup> this species runs to *delicatus* Howard. It differs from *delicatus*, however, as well as from all related species, especially in the exceptionally dark posterior tibiae and in the unusual coloring of the posterior tarsi, which have the basal segment black, the second and fifth segments slightly dusky, and the third and fourth pale yellow.

*Female*.—Length, barely 2 mm.\* Head about as wide as mesonotum; face broad, finely punctate; antennae slightly shorter than the body, the apical segments considerably shortened. Mesoscutum entirely closely punctate and opaque; scutellum shining, with sparse but distinct punctures; propodeum very short, entirely closely rugulose, median carina indistinct; posterior coxae smooth and shining; posterior tibiae short and rather strongly thickened apically; spurs of hind tibia subequal and not distinctly half as long as metatarsus;

\* Proc. U. S. Nat. Mus., vol. 58, p. 500, 1920.



stigma short and broad, emitting radius from its middle, the latter perpendicular to anterior wing margin and slightly longer than intercubitus; second abscissa of cubitus unusually short, only about half as long as intercubitus. Abdomen short and stout; first and second tergites combined longer than remainder of dorsum of abdomen; chitinated plate of first tergite broadening apically, entirely finely rugulose; second and third tergites subequal in length, the second completely, the third except at apex, closely finely rugulose and opaque; hypopygium not surpassing apex of last tergite; ovipositor sheaths barely exerted. Black; tegulae blackish; wings hyaline, stigma and veins brown; all coxae black; trochanters, femora, and tibiae of anterior and middle legs yellow, their tarsi whitish; posterior legs with trochanters and femora yellow, the tibiae black, pale only at extreme base, their tarsi with the basal segment black, the second and fifth segments more or less dusky, and the third and fourth segments pale yellow.

*Type*.—U.S.N.M. No. 42872, from Raubsville, Pa.

*Host*.—An undertermined Cochlidiid.

Four females reared August 15, 1929, by J. V. Schaffner, jr., under Gipsy Moth Laboratory No. 12164 R128.

APANTELES HALISIDOTAE, new species

Runs to *phobetri* Rohwer in the key to the North American species (loc. cit.) and is very similar to that species. It is distinguished, however, by its larger size and by the relatively longer and more oblique intercubitus, which is as long as the radius and is strongly angled with the latter; in addition, the subdiscoideus is much more distinct, being well pigmented, while in *phobetri* its location is indicated only by rows of closely placed setae. Both species are gregarious parasites, but the cocoons of the two are strikingly different, being pale buff and exposed in the case of *phobetri*, while those of *halisidotae* are pure white and inclosed in the cocoon of the host.

*Female*.—Length, 3 mm. Head as broad as mesonotum; face weakly punctate, shining; antennae as long as the body, the apical segments only gradually shorter, mesoscutum entirely closely punctate; scutellum somewhat convex, polished, practically impunctate; propodeum finely rugulose, narrowly smooth at extreme base, and with a weak indication of a median longitudinal carina; stigma moderately large, more than twice as long as broad; radius obliquely directed outwardly, not longer than intercubitus and sharply angled with the latter, which is strongly oblique; subdiscoideus distinct to wing margin; posterior coxae smooth and shining; inner spur of posterior tibia a little longer than the outer and slightly more than half as long as metatarsus. Abdomen long-ovate, somewhat compressed apically; first abdominal tergite broadening gradually to

the apex, very finely ruguloso-punctate laterally and at apex, smooth and highly polished medially at base, this polished area narrowing posteriorly but extending to apical fourth of tergite; second tergite shorter than the third, finely rugulose except for broad lateral margins, which are smooth; the sculptured plate set off by irregular, somewhat oblique, impressed lines; third and following tergites polished; hypopygium not surpassing apex of last tergite; ovipositor sheaths only slightly exerted. Black; tegulae black; wings hyaline; stigma and veins brown; all coxae black; remainder of legs yellow, except apex of posterior femora above, apex of posterior tibiae, and the posterior tarsi, which parts are black; lateral membranous margins of first and second tergites brown, darker on second tergite than on first.

*Male*.—Like the female in essential characters.

*Type*.—U.S.N.M. No. 42873, from Shirley, Me.

*Host*.—*Halisidota maculata* Harris.

*Cocoons*.—Pure white, gregarious, inclosed within the cocoon of the host.

Described from five females and three males reared June 14, 1928, by J. V. Schaffner, jr., in the Bureau of Entomology, under Gipsy Moth Laboratory No. 12451 N25. At the Gipsy Moth Laboratory there are additional series, not included among the type material, from Winterport, Patten, Hampden, Wallagrass, Fort Kent, Eagle Lake, Grand Isle, Van Buren, St. John, Ashland, and Presque Isle, Me.; Chateaugay and Nicholville, N. Y.; Hopkinton, N. H.; and Cheshire, Mass. All this material was reared from *Halisidota maculata*.

#### APANTELES CINGILIAE, new species

Most similar to *koebeleri* Riley but differing particularly in the less strongly compressed abdomen and the completely black hind femora.

*Female*.—Length, 2.7 mm. Head nearly as wide as mesonotum; face only very slightly broader than long, shining, sparsely shallowly punctate; antennae about as long as the body or only indistinctly shorter, even the apical segments elongate. Thorax stout; mesoscutum closely punctate, shining; scutellum with a few distinct punctures; propodeum closely rugulose, very narrowly smooth and shining at extreme base, and with a complete median longitudinal carina; posterior coxae large, mostly smooth; inner spur of posterior tibia longer than the outer and more than half as long as metatarsus; radius arising from a little beyond middle of stigma and not longer than intercubitus, with which it is rather strongly angled. Abdo-

men about as long as thorax, not broad, a little compressed apically; chitinized plate of first tergite broadening gradually posteriorly, mostly smooth on basal half, delicately rugulose apically; second tergite much shorter than third, more than twice as broad as long, very finely rugulose, opaque laterally, shining medially; following tergites smooth and polished; hypopygium attaining apex of abdomen; ovipositor sheaths barely exerted. Black; tegulae black; all coxae and basal segment of trochanters black; apical segment of all trochanters mostly yellowish: remainder of anterior legs yellow, except the femora at base beneath blackish; middle femora yellowish on outer side, mostly blackish within and below; middle tibiae and tarsi yellow; posterior legs with femora black, their tibiae yellowish, black on apical fourth or third, their tarsi black; wings hyaline, stigma and veins brown.

*Male*.—Like the female in the essential characters.

*Type*.—U.S.N.M. No. 42874, from Bernardston, Mass.

*Host*.—*Cingilia catenaria* Drury.

*Cocoons*.—White, or yellowish white, apparently gregarious, but loose and not inclosed in a mass of silk.

Eight females and two males reared August 26, 1929, by J. V. Schaffner, jr., under Gipsy Moth Laboratory No. 12418 R7.

#### PAROLIGONEURUS, new genus

This is a genus of Microgasterinae and is very closely related to *Oligoneurus* Szepligeti, the genotype and only described species of which is from Brazil. It strikingly resembles *Oligoneurus* in the unusual wing venation, the broad head, the widely separated antennae, and the small posterior coxae and short tibial spurs, but differs especially in having bare eyes and antennae with fewer segments.

Head transverse, though not strongly so, a little broader than thorax, immargined behind; eyes practically bare; antennae 18-segmented, inserted unusually high on face and widely separated at base; frons short, only slightly descending anteriorly; notauli wanting; prepectus immargined; posterior coxae small; spurs of posterior tibiae very short; radial cell open, radius represented only by a short spur; both intercubiti wanting, all cubital cells therefore confluent; cubitus and basal vein separated at base, arising independently from parastigma; first brachial cell open; nervulus interstitial with basal vein; abdomen short, the chitinized plates of the first and second tergites similar to those of some species of *Apanteles*.

*Genotype*.—*Paroligoneurus johnsoni*, new species.

## PAROLIGONEURUS JOHNSONI, new species

## FIGURE 1

*Female*.—Length 1.8 mm. Head a little wider than thorax; face large, evenly convex, smooth and shining, with only weak setigerous punctures; clypeus rather large, indistinctly separated from face, shallowly transversely impressed before apex, the anterior margin evenly rounded; antennae 18-segmented, nearly as long as the body; pedicel elongate, about two-thirds as long as the scape; all 16 flagellar segments well separated, elongate, the first four times as long as thick and considerably longer than the second; eyes bare, with only a few scattered indistinct hairs; cheeks and temples convex. Thorax short, compact; mesoscutum flat, smooth, and shining, impunctate, with no trace of notauli; suture between mesoscutum and scutellum fine, smooth, not foveolate; scutellum very slightly convex, smooth and shining; propodeum smooth and polished, not areolated; pleura polished; mesopleura without a furrow; posterior coxae small; inner spur of posterior tibia longer than the outer but hardly one-third the length of metatarsus; stigma

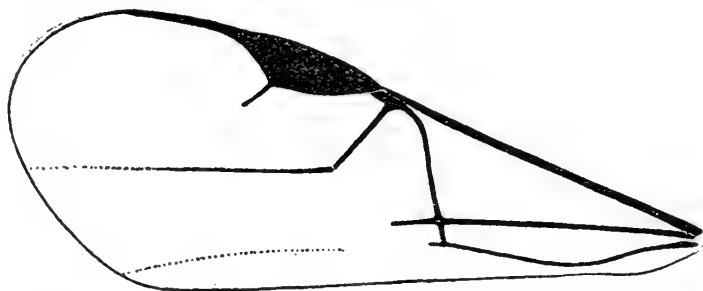


FIGURE 1.—Anterior wing of *Paroligoneurus johnsoni*, new species

moderately broad, a little longer than metacarpus; radius arising from beyond middle of stigma and consisting merely of an oblique, outwardly directed stub; cubitus and basal vein separated at their points of origin on parastigma; basal vein at origin distinctly curved toward base of wing; cubitus obsolescent apically; nervulus interstitial; recurrent vein wanting, or at least not distinctly developed; discoideus distinct only at base, the first discoidal cell, therefore, open; first brachial cell open. Abdomen narrower than thorax, entirely polished; first tergite with a median elongate plate that is strongly narrowed at apex; second tergite with a triangular median plate that is very narrow at extreme base; lateral membranous margins on first and second tergites very broad; hypopygium large, apparently slightly surpassing apex of last tergite; ovipositor sheaths projecting the length of the first tergite beyond apex of abdomen. Head brown, blackish above and behind; thorax black; abdomen brownish on basal half, blackish on apical half; wings hyaline, stigma and veins brown; legs yellow, the posterior coxae blackish above toward base.

*Type*.—U.S.N.M. No. 42876, from Nantucket, Mass.  
One female collected by C. W. Johnson, August 17, 1927.

Genus **SNELLENIUS** Westwood

*Snellenius* WESTWOOD, Tijdschr. Ent., vol. 25, p. 19, 1882. (Genotype, *Snellenius vollenhovenii* Westwood.)

This genus is discussed here in order to place it definitely in the Microgasterinae. Ashmead<sup>4</sup> assigned it to the Agathidinae (now Braconinae), where Szepligeti<sup>5</sup> also placed it, although in his original description Westwood had called attention to the similarity in venation to *Microgaster*. Both Ashmead and Szepligeti apparently knew *Snellenius* only from literature. Schulz,<sup>6</sup> who had specimens before him, commented on some of the more striking characters but failed to indicate the position of the genus.

Examination of the genotype, which is in the Hope Museum, Oxford, England, has convinced me that *Snellenius* is referable to the Microgasterinae, and that within this group it appears most closely related to *Microplitis* Foerster, although the very small head and the carinately margined prepectus suggest a certain affinity with *Odontofornica* Enderlein (now *Fornicia* Brullé). In wing venation, in the structure of the abdomen, and in the relatively small posterior coxae and the short tibial spurs, *Snellenius* is very similar to *Microplitis*. In the latter group there is also an approach toward certain thoracic structures found in *Snellenius*, including the occasional presence of distinct notauli, the very prominent median propodeal carina, and the strongly declivous propodeum.

The following notes, taken from the genotype, are presented to supplement Westwood's original description and so to contribute toward a clearer understanding of the genus and species: Head very small, transverse; eyes hairy; antennae strongly compressed, 18-segmented (not 17-segmented as noted by Westwood, who apparently overlooked the very short, mostly concealed pedicel). Thorax stout; prepectus carinately margined; notauli present; middle lobe of mesoscutum flat but somewhat elevated; a short median keel posteriorly on mesoscutum; suture between scutum and scutellum broad and deep; scutellum margined laterally, elevated down the middle, impressed either side of this elevation; propodeum with a strong median longitudinal keel and prominent transverse ridges extending laterally from this; dorsal face of propodeum horizontal, the posterior face vertical. Abdomen short; first tergite with a long, narrow, nearly parallel-sided, chitinized plate, and on either side of this with broad membranous margins; posterior coxae not large; spurs

<sup>4</sup> Proc. U. S. Nat. Mus., vol. 23, p. 129, 1900.

<sup>5</sup> Genera Insectorum, fasc. 22, p. 116, 1904.

<sup>6</sup> Zool. Annalen, vol. 4, p. 62, 1911 (1909).

of posterior tibiae short; radial cell incomplete, the second abscissa of radius only weakly indicated; second cubital cell small, subtriangular, complete.

**SNELLENII PHILIPPINENSIS (Ashmead) (new combination)**

*Microplitis philippinensis* ASHMEAD, Journ. New York Ent. Soc., vol. 12, p. 20, 1904.

Apparently the strongly compressed condition of the antennae in the genotype of *Snellenius* is not of generic importance. The antennae of *Microplitis philippinensis* Ashmead, the type material of which is in the United States National Museum, are not unusually compressed; but, in my opinion, the species is unquestionably referable to *Snellenius*. It agrees with the genotype, *S. vollenhovenii* Westwood, in all important respects, including the margination of the prepectus.

**Genus DIRRHOPE Foerster**

*Dirrhope* FOERSTER, Verh. Naturh. Ver. Preuss. Rheinl., vol. 7, p. 39, 1851.  
(Genotype, *Dirrhope rufa* Foerster.)

In his "Synopsis der Familien und Gattungen der Braconiden,"<sup>7</sup> Foerster separated his Microgasteroidae, on the basis of hairy eyes, from the groups he called the Agathidoidae and Eumicrodoidae. He placed *Dirrhope* in the Microgasteroidae, and it unquestionably belongs there, but it will not run to that group in his key because the eyes of the genotype are distinctly bare. *Dirrhope* further differs from most Microgasterinae but agrees with *Snellenius* Westwood and *Odontoformica* Enderlein (now *Fornicia* Brullé) in having the prepectus distinctly margined.

**Subfamily NEONEURINAE**

**Genus NEONEURUS Haliday**

*Neoneurus* HALIDAY, Ent. Mag., vol. 5, p. 213, 1838. (Genotype, *Neoneurus halidaii* Marshall.)

*Ecclites* FOERSTER, Verh. Naturh. Ver. Preuss. Rheinl., vol. 19, p. 244, 1862.  
(Genotype, *Ecclites clypeatus* Foerster.)

Ashmead<sup>8</sup> synonymized *Ecclites* Foerster with *Neoneurus* Haliday. But somewhat later Bengtsson<sup>9</sup> stated that Ashmead's conclusion was undoubtedly wrong; and Muesebeck<sup>10</sup> concurred, suggesting that *Ecclites* might belong to the Blacinae. Examination of the genotypes of both genera shows, however, that Ashmead was correct and that *Ecclites* Foerster must be held as a synonym of *Neoneurus* Haliday as typified by *N. halidaii* Marshall. In view of the misunderstanding evidenced by the literature referred to above, it

<sup>7</sup> Verh. Naturh. Ver. Preuss. Rheinl., vol. 19, pp. 225-283, 1862.

<sup>8</sup> Proc. U. S. Nat. Mus., vol. 19, p. 130, 1900.

<sup>9</sup> Lund Univ. Arsskr. N. F. And. 2, vol. 14, no. 32, 1918.

<sup>10</sup> Proc. U. S. Nat. Mus., vol. 61, p. 2, 1922.

has seemed advisable to include this note, which is based on a study of the types of both *Neoneurus halidaii* Marshall and *Ecclitis clypeatus* Foerster.

Subfamily OPIINAE

Genus RHINOPLUS Foerster

*Rhinoplus* FOERSTER, Verh. Naturh. Ver. Preuss. Rheinl., vol. 19, p. 258, 1862.  
(Genotype, *Rhinoplus laevigatus* Foerster.)

Since the description of this opiine genus, with *R. laevigatus* as the only included species, two African species have been referred to it, namely, *R. fuscipennis* Szepligeti and *R. fulvus* Brues. Neither of these, however, properly belongs in *Rhinoplus*, both Szepligeti and Brues having misinterpreted Foerster's characterization of the genus on the basis of "Clypeus mit starkem Horn." Foerster's genotype, which I have seen, has the clypeus large and provided with a striking hornlike tubercle situated in the middle and projecting forward at right angles to the surface. The structure is very conspicuous, and while there may be some question as to its value as a generic character it nevertheless sets off *R. laevigata* from all other known Opiinae and, for the present at least, is to be considered of generic importance. Both *fuscipennis* Szepligeti and *fulvus* Brues merely have the anterior margin of the clypeus somewhat angled or toothed at the middle, there being no indication of the horn that is characteristic of *Rhinoplus*. They are accordingly to be excluded from that genus, and, in my opinion, are referable to *Opius* Wesmael.

OPIUS FUSCIPENNIS (Szepligeti) (new combination)

*Rhinoplus fuscipennis* SZEPLIGETI, Mitt. Zool. Mus. Berlin, vol. 7, p. 226, 1914.

OPIUS FULVUS (Brues) (new combination)

*Rhinoplus fulvus* BRUES, Proc. Amer. Acad. Arts and Sci., vol. 61, p. 259, 1926.

OPIUS GAHANI, new name

*Opius fuscipennis* GAHAN, Proc. U. S. Nat. Mus., vol. 49, p. 79, 1915 [not *fuscipennis* (Szepligeti)].

The transfer of *Rhinoplus fuscipennis* Szepligeti to *Opius* unfortunately makes necessary the renaming of *Opius fuscipennis* Gahan.

Genus OPIUS Wesmael

*Opius* WESMAEL, Nouv. Mem. Acad. Sci. Bruxelles, vol. 9, p. 115, 1835. (Genotype, *Bracon carbonarius* Nees.)

*Psytalia* WALKER, Ann. Mag. Nat. Hist., ser. 3, vol. 5, p. 311, 1860. [Genotype, *Psytalia testacea* Walker (new synonymy).]

This synonymy is published here, following an examination of the genotype of *Psytalia*, in order to make clear the identity of that genus, regarding the position of which there has been some question. The following notes, based on the type of *P. testacea*, are included to

supplement Walker's description: Runs to *Opius* in keys by Szepilgeti<sup>11</sup> and Gahan.<sup>12</sup> Head behind margined only laterally; a transverse opening between clypeus and mandibles. Mesoscutum polished; notauli very short, distinct only anteriorly; propodeum polished and provided with a median longitudinal carina; second abscissa of radius much longer than first intercubitus; third abscissa of radius going to extreme wing apex; three cubital cells; recurrent vein entering first cubital cell considerably before first intercubitus. Hypopygium rather large; ovipositor sheaths fully as long as the abdomen.

Since *testacea* Walker, the genotype of *Psytalia* and the only included species, is preoccupied in *Opius*, it becomes necessary to change that specific name upon synonymizing the genus.

**OPIUS WALKERI, new name**

*Psytalia testacea* WALKER, Ann. Mag. Nat. Hist., ser. 3, vol. 5, p. 311, 1860 (not *testaceus* Wesmael).

Subfamily ALYSIINAE

**Genus HERATEMIS Walker**

*Heratemis* WALKER, Ann. Mag. Nat. Hist., ser. 3, vol. 5, p. 310, 1860. (Genotype, *Heratemis filosa* Walker.)

This is another of Walker's genera that have apparently remained unrecognized owing to the unsatisfactory original characterization. The following notes, taken from the genotype, are given here in order to supplement the original description and to aid in the recognition of this genus, which appears to be most closely related to *Phaenocarpa* Foerster: Head large, although transverse; temples with a weak but distinct posterior tubercle; antennae exceptionally long and slender; first flagellar segment shorter than the second. Notauli strongly impressed; middle lobe of scutum prominent; scutellum drawn out into a conspicuous elevated hornlike projection at apex; propodeum areolated; posterior coxae with a blunt tooth beneath at base; radius arising from beyond middle of stigma; radial cell large, extending to extreme apex of wing; three cubital cells; first cubital and first discoidal cells separated; recurrent vein entering first cubital cell at extreme apex; second abscissa of radius a little longer than first intercubitus; first brachial cell closed, long and narrow; radiellian cell very large, much widened apically. Abdomen long and slender.

Subfamily MACROCENTRINAE

**Genus XIPHOZELE Cameron**

*Xiphozele* CAMERON, Ent., vol. 39, p. 204, 1906. (Genotype, *Xiphozele compressiventris* Cameron.)

*Cerotopia* ENDERLEIN, Archiv. f. Naturg., vol. 84, Abt. A, Heft 11, p. 219, 1920 (1918). [Genotype, *Cerotopia cornicimacula* Enderlein (new synonymy).]

<sup>11</sup> Genera Insectorum, fasc. 22, p. 159, 1904.

<sup>12</sup> Proc. U. S. Nat. Mus., vol. 49, p. 67, 1915.



In a paper on Ethiopian Braconidae, Brues (1926)<sup>13</sup> included *Xiphozele* in his key to the Macrocentrinae and explained that he had omitted *Cerotopia* because he did not know the genus and since it had not been originally sufficiently well characterized to make recognition possible. After an examination of the genotypes of both genera I find that *Cerotopia* must be suppressed as a synonym of *Xiphozele*. Furthermore, in my opinion, *C. corneimacula* Enderlein is conspecific with *X. compressiventris* Cameron.

#### XIPHOZELE COMPRESSIVENTRIS Cameron

*Xiphozele compressiventris* CAMERON, Ent., vol. 39, p. 204, 1906.

*Cerotopia corneimacula* ENDERLEIN, Archiv. f. Naturg., vol. 84, Abt. A, Heft 11, p. 220, 1920 (1918) (new synonymy).

#### Subfamily HELORIMORPHINAE

##### Genus HELORIMORPHA Schmiedeknecht

*Helorimorpha* SCHMIEDEKNECHT, Die Hymenopteren Mitteleuropas, p. 523, 1907. (Genotype, *Helorimorpha egregia* Schmiedeknecht.)

*Stictometeorus* CAMERON, Soc. Ent., vol. 24, p. 9, 1909. (Genotype, *Stictometeorus rufus* Cameron.)

*Erythrometeorus* CAMERON, Timehri Journ. Roy. Agr. Com. Soc. British Guiana, vol. 1, p. 317, 1911. (Genotype, *Erythrometeorus reticulatus* Cameron.)

*Scipolabia* ENDERLEIN, Archiv. f. Naturg., vol. 84, Abt. A, Heft 11, p. 220, 1920 (1918). [Genotype, *Scipolabia reticulata* (new synonymy).]

*Stictometeorus* was synonymized with *Helorimorpha* by Brues,<sup>14</sup> and Turner<sup>15</sup> later pointed out that *Erythrometeorus* also is a synonym of this cosmopolitan genus, but both authors apparently overlooked Enderlein's *Scipolabia*, the genotype of which is likewise a typical *Helorimorpha*. The name *reticulata* Enderlein being pre-occupied by *reticulatus* Cameron, it becomes necessary to propose a new name for the former species, which appears to be distinct although closely related to *brasiliensis* Brues.

#### HELORIMORPHA ENDERLEINI, new name

*Scipolabia reticulata* ENDERLEIN, Archiv. f. Naturg., vol. 84, Abt. A, Heft 11, p. 220, 1920 (1918) [not *reticulatus* (Cameron)].

#### Subfamily ROGADINAE

##### Genus ROGAS Nees

*Rogas* NEES, Nov. Act. Nat. Curios, vol. 9, p. 306, 1818. (Genotype, *Bassus testaceus* Fabricius.)

*Nebartha* WALKER, Ann. Mag. Nat. Hist., ser. 3, vol. 5, p. 310, 1860. [Genotype, *Nebartha macropodides* Walker (new synonymy).]

*Nebartha* is still another of Walker's genera concerning the position of which there has been much uncertainty. In his original characterization of the genus Walker emphasized a relationship with

<sup>13</sup> Proc. Amer. Acad. Arts and Sci., vol. 61, p. 274, 1926.

<sup>14</sup> Ann. South African Mus., vol. 19, p. 101, 1924.

<sup>15</sup> Ann. Mag. Nat. Hist., ser. 9, vol. 20, p. 558, 1927.

*Coelinius* Nees. Examination of the genotype shows, however, that it has little in common with *Coelinius*, and that it is rather a perfectly normal *Rogas*. The head is transverse; eyes somewhat emarginate; a circuliform opening between clypeus and mandibles; abdomen depressed; the first three tergites large, occupying most of the dorsum of abdomen, all three longitudinally rugulose on a granular surface, the first and second with a median longitudinal carina which also extends weakly upon base of third.

**ROGAS MACROPODIDES (Walker) (new combination)**

*Nebartha macropodides* WALKER, ANN. Mag. Nat. Hist., ser. 3, vol. 5, p. 310, 1860.

**Genus YELICONES Cameron**

*Yelicones* CAMERON, Biol. Centr. Amer. Hym., vol. 1, p. 337, 1887. (Genotype, *Yelicones violaccipennis* Cameron.)

*Rhopalotoma* CAMERON, Timehri Journ. Roy. Agr. Com. Soc. British Guiana, vol. 1, p. 318, 1911. [Genotype, *Rhopalotoma crassitarsis* Cameron (new synonymy).]

I have examined the genotypes of both genera and am convinced that they are unquestionably congeneric. They agree in all essentials of wing venation and in the head, thoracic, abdominal, and striking leg characters.

**YELICONES CRASSITARSIS (Cameron) (new combination)**

*Rhopalotoma crassitarsis* CAMERON, Timehri Journ. Roy. Agr. Com. Soc. British Guiana, vol. 1, p. 318, 1911.

**Subfamily DORYCTINAE**

**Genus EUSCELINUS Westwood**

*Euscelinus* WESTWOOD, Tijdschr. Ent., vol. 25, p. 25, 1882. (Genotype, *Euscelinus sarawacus* Westwood.)

In his "Classification of the Ichneumon Flies," Ashmead (1900)<sup>16</sup> assigned this genus to the subfamily Helconinae. Szepligeti (1904),<sup>17</sup> apparently knowing it only from literature, likewise placed it in the Helconinae although only in his supplement to that group, omitting it from the key. The same year Ashmead<sup>18</sup> described *Euscelinus manilae*, but even with a specimen before him, he retained the genus in the Helconinae.

I have examined Westwood's genotype, which is in the Hope Museum at Oxford, as well as the type of *E. manilae*, which is in the United States National Museum, and as a result am referring the genus to the Doryctinae. It runs direct to the Doryctinae in Szepligeti's classification and undoubtedly belongs in that group as at present defined. In placing *Euscelinus* in the Helconinae, Ashmead

<sup>16</sup> Proc. U. S. Nat. Mus., vol. 23, p. 120, 1900.

<sup>17</sup> Genera Insectorum, fasc. 22, p. 153, 1904.

<sup>18</sup> Proc. U. S. Nat. Mus., vol. 28, p. 145, 1904.

apparently overlooked the distinct circuliform mouth opening and was unduly influenced by the unusually stout and dentate posterior femora.

*E. manilae* Ashmead is clearly congeneric with the genotype.

Subfamily VIPIINAE

MICROBRACON RHYACIONIAE, new species

Runs to couplet 37 in my key to the North American species of *Microbracon*<sup>19</sup> and is most similar to *pini* Muesebeck, but differs from that species especially in the mostly testaceous abdomen, the generally darker legs, the somewhat longer ovipositor sheaths, and the relatively narrower head.

*Female*.—Length, 3.8 mm. Head distinctly narrower than thorax, moderately thick antero-posteriorly, smooth and shining; face with a little faint punctation; diameter of mouth opening considerably greater than distance from the opening to the eyes; antennae of type 33-segmented, slender, tapering slightly apically; first flagellar segment about twice as long as broad, the following a little shorter but all distinctly longer than broad. Thorax stout, smooth, and polished, notauli lined with long delicate hairs; propodeum polished, without oblique rugae behind; pleura smooth; second abscissa of radius about twice the first; the third about as long as the first and second abscissae combined. Abdomen longer than thorax, mostly polished; first tergite very weakly roughened, the grooved lines setting off the large median triangular plate foveolate; second tergite strongly transverse, its posterior margin arcuate, the surface of the tergite mostly smooth, with only a little weak sculpture medially; suturiform articulation rather broad; third and following tergites polished, the sutures very fine; ovipositor sheaths slender, a little longer than the abdomen. Head and thorax entirely black; all legs black or blackish; wings weakly infumated; abdomen testaceous, with a median blackish area on first tergite and very small blackish median patches on third, fourth, and fifth tergites.

*Male*.—In essentials similar to the female; antennae 32-segmented; apical abdominal tergites almost entirely black.

*Type*.—U.S.N.M. No. 42875, from Pactola, S. Dak.

*Host*.—*Rhyacionia* on western yellow pine (*Pinus ponderosa*.)

Eight females and two males reared in August, 1926, by L. G. Baumhofer under Hopkins U. S. No. 17511.

Female paratypes present slight variations in the color of the abdomen, which varies from entirely testaceous to rather broadly black medially on third and following tergites. There is also a slight variation in the number of antennal segments.

<sup>19</sup> Proc. U. S. Nat. Mus., vol. 67, p. 12, 1925.

## MICROBRACON CRYPTORHYNCHI, new species

Most similar to *hyslopi* Viereck but differs especially in the longer radial cell, which practically attains wing apex, the unicolorous dark brown stigma, the entirely black mesonotum, and the yellow legs.

*Female*.—Length, 4 mm. Head transverse, not very prominent at insertion of antennae, fully as wide as thorax; face very delicately granular and subopaque, smooth medially; frons and vertex smooth and shining; transverse diameter of mouth opening somewhat greater than distance from the opening to the eyes; antennae of type slender, not so long as the body, 33-segmented, all flagellar segments longer than broad. Thorax moderately stout; mesoscutum and scutellum polished; notauli weak, lined with sparse hairs; propodeum polished, with only a very short stub of a median ridge at apex and a few short rugae radiating from this; second abscissa of radius more than twice the first; the third as long as the first and second combined, and as long as last abscissa of cubitus; radial cell going practically to apex of wing. Abdomen stout, longer than thorax; first tergite finely rugulose; second tergite as long as the third, finely though not closely punctato-granular, except along posterior margin where it is smooth; second suture not broad, practically straight; third and following tergites polished: ovipositor sheaths about as long as the abdomen. Head and thorax entirely black; all legs testaceous, with only middle and posterior coxae blackish above at base; wings hyaline; abdomen brownish testaceous; the first tergite and a small triangular basal median spot on second, black.

*Male*.—Essential characters as in the female, except that antennae are 32-segmented, the first and second abdominal tergites are more weakly sculptured, and the fourth and following tergites are black.

The number of segments in the antennae of the female paratypes varies from 30 to 33 with only 26 in one unusually small specimen, and in the case of the males from 32 to 34. The male paratypes agree with the allotype in having the abdomen beyond third tergite black; in the females, this part of the abdomen varies from entirely brownish testaceous to entirely black.

*Type*.—U.S.N.M. No. 42877, from Melrose Highlands, Mass.

*Host*.—*Cryptorhynchus lapathi* Linnaeus.

Twelve females and six males reared by J. V. Schaffner, jr., in May, June, and July, 1924, under Gipsy Moth Laboratory No. 12164 J5.

A NEW SPECIES OF TREMATODE OF THE FAMILY  
HETEROPHYIDAE, WITH A NOTE ON THE GENUS  
APOPHALLUS AND RELATED GENERA

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During the summer of 1929, Dr. Eloise B. Cram, of the Zoological Division, Bureau of Animal Industry, conducted an investigation in cooperation with representatives of the Bureau of Biological Survey to determine if parasites were a factor in causing the death of ducks from the so-called "duck disease" at Klamath Falls, Oreg. Among the specimens of parasites collected from water birds in this vicinity were a number of trematodes, one species of which appears to be new. This fluke belongs to the family Heterophyidae Odhner, 1914, and to the genus *Apophallus* Lühe, 1909. For this trematode the name *Apophallus crami* is proposed, the species being named for the collector.

**APOPHALLUS CRAMI, new species**

FIGURE 1

*Specific diagnosis.*—*Apophallus*: Body slender, 1.5 mm. to 1.9 mm. long by  $279\mu$  to  $341\mu$  wide in the vicinity of the testes; preacetabular portion of body flattened and showing a slight constriction in the region between the acetabulum and the intestinal bifurcation; postacetabular portion more or less cylindrical. The cuticle is covered with small scalelike spines. Oral sucker subterminal,  $45\mu$  to  $60\mu$  in diameter; prepharynx very short; pharynx ovoid,  $45\mu$  long by  $30\mu$  wide. Esophagus slender, about  $337\mu$  long, bifurcating about one-fifth of the body length from the anterior end; intestinal ceca slender, extending to near the posterior end of the body. Acetabulum  $52\mu$  to  $62\mu$  in diameter, situated at the equator of the body and opening into the genital sinus. Genital pore at anterior end of genital sinus, the aperture being guarded by two ovoid, papillalike gonotyls. Testes globular or slightly ovoid in shape and placed obliquely in the poste-

rior fourth of the body, the right caudad of the left. The left testis is  $180\mu$  to  $187\mu$  in diameter and the right  $150\mu$  to  $160\mu$  long by  $187\mu$  to  $210\mu$  wide. Seminal vesicle well developed, S-shaped, and situated in the median line caudad of the acetabulum. Ovary globular or slightly ovoid in shape,  $75\mu$  to  $97\mu$  in greatest diameter, situated a short distance in front of the anterior testis and to the right of the median line. Seminal receptacle ovoid,  $50\mu$  to  $67\mu$  long by  $60\mu$  to  $82\mu$  wide, and situated immediately caudad of the ovary. The vitellaria are composed of relatively large follicles, which extend anteriorly to about  $150\mu$  to  $155\mu$  caudad of acetabulum; posteriorly they extend to the posterior end of the body and almost completely fill the post-testicular space. Uterus with relatively few loops and confined to the intercecal space between ovary and acetabulum. Eggs ovoid,  $33\mu$  long by  $25\mu$  wide, with yellowish-brown shells.

*Host*.—California gull (*Larus californicus*).

*Location*.—Lower part of small intestine.

*Distribution*.—United States (Klamath Falls, Oreg.).

*Type specimen*.—U.S.N.M. Helm. Coll. No. 29245; paratypes No. 29779.

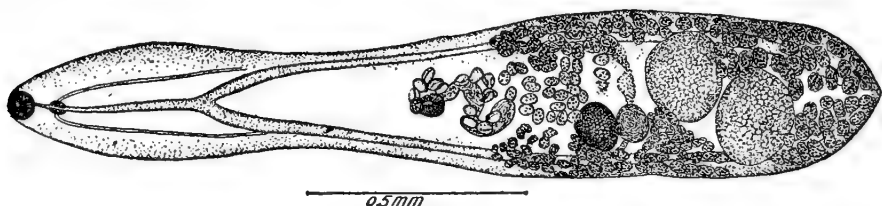


FIGURE 1.—*Apophallus crami*, new species. Ventral view

*Remarks*.—*Apophallus crami* resembles *A. mühlingi* (Jägerskiöld) more closely than it does any of the other species of the genus, the principal difference between the two being in the extent of the vitellaria anteriorly. In *A. mühlingi* the vitellaria extend anteriorly to the level of the acetabulum, while in *A. crami* they stop abruptly at or near the level of the posterior end of the seminal vesicle. Other minor differences exist, but they are not regarded as being of particular specific value. The distribution of the vitellaria appears to be a constant character in members of the genus. In the species described in this paper, about 100 specimens were examined, and the variation as regards this character was found to be insignificant. In one specimen the vitelline follicles on the left side were found to extend as far anterior as the acetabulum, but on the right side they did not extend beyond the posterior margin of the seminal receptacle. This specimen was clearly an anomalous one and of no significance so far as the constancy of the distribution of the vitellaria is concerned.

## APOPHALLUS AND RELATED GENERA

The species that have been assigned to the genus *Apophallus* by previous writers are as follows: *Apophallus mühlingi* (Jägerskiöld, 1899), Lühe, 1909 (type of genus), *A. brevis* Ransom, 1920, and *A. major* Szidat, 1924. According to Witenberg (1929), *A. major* is a synonym of *A. mühlingi* and *A. brevis* a synonym of *Rossicotrema donicum* Skrjabin and Lindtrop, 1919. The writer has reexamined the type specimens of *A. brevis* and feels that it should be regarded as a distinct species, at least until more material is available for study. According to the writer's conception of the genus it stands closer to *A. mühlingi* than to *R. donicum*.

In a recent paper, Witenberg (1930) states that "after restudying the available material of the genera *Rossicotrema*, Skrjabin, and *Tocotrema* (Looss), I concluded that they shall not be regarded as distinct ones, as they are presented in my paper. The differences between their representatives are rather of specific value, not greater than say between *Parascocotyle longa* (Ransom) and any other species of the genus *Parascocotyle*, i. e., in the number of gonotyls. I therefore find it suitable to regard the genus *Rossicotrema* as synonym of *Tocotrema*." In view of this statement the writer has examined the available material of the species of *Rossicotrema* and related genera, but can not concur in Witenberg's conclusion. A brief review of the case shows the following situation:

Ransom (1920) recognized the genus *Cryptocotyle* Lühe as valid and *Tocotrema* Looss as a synonym and stated: "Looss (1899b) took *lingua* as type of the genus *Tocotrema*, but its characters are so similar to those of the type of *Cryptocotyle* (*C. concava*) that the two can not be separated generically." On the contrary, Witenberg (1929) states: "In the species designated as types for *Cryptocotyle* and *Tocotrema* essential differences exist in the arrangement of the testes and in the shape of the body, both these characters being correlated. Thus, these two species can not be retained in one genus but must be separated: i. e., both *Cryptocotyle* and *Tocotrema* should be considered valid." The generic name *Ciureana* Skrjabin, 1923, is made a synonym of *Cryptocotyle*. Africa (1929) found considerable variation in the position of the testes in a small number of specimens of *C. lingua* and noted that out of ten specimens two showed the testes opposed as in *C. concava* and the others varied from this type to that described for *C. lingua*, and he states: "It seems that there is a wide range of variation both as to shape and position in the same species of the hitherto believed to be fixed structures." The writer has examined a number of specimens of species of *Cryptocotyle* and of the related genus *Rossicotrema* and is convinced that the "arrangement of the testes" and the "shape of the body"

are correlated characters but not characters of generic value. In specimens of *C. lingua* some were found in which the body was ovoid or piriform in shape and the testes opposite each other, while in others from the same lot these characters conform to the usual type, that is, body linguiform in shape and the testes placed obliquely to the long axis. The same variations were observed in specimens of *Rossicotrema donicum*. From these observations it is the writer's opinion that the position of the testes in the Heterophyidae, and possibly also in members of some of the other families, depends upon the shape of the body, and both body shape and position of testes depend upon the state of contraction of the specimens when killed.

It is frequently difficult to decide upon the relative value of characters and to determine which are of generic and which are of specific value. This is especially true with respect to the trematodes. In checking over the characters as given for the genera *Cryptocotyle* Lühe, *Tocotrema* Looss, *Ciureana* Skrjabin, *Rossicotrema* Skrjabin and Lindtrop, and *Apophallus* Lühe, only one character appears sufficiently constant to be of generic value, namely, the genital sinus and the arrangement of its accessory structures. In the first three of these genera the genital sinus is a spacious, somewhat muscular structure; the acetabulum is greatly reduced and situated in the anterior wall of the sinus; the genital aperture is post-acetabular; and the genital ducts open into the sinus caudad of the acetabulum at the base of a single, papillalike gonotyl. In the genera *Rossicotrema* (syn. *Cotylophallus*) and *Apophallus* this arrangement is entirely different. The genital sinus is reduced in size and its walls weakly developed; the acetabulum is relatively strongly developed and opens into the sinus caudad of the genital pore; the genital ducts open into the sinus cephalad of the acetabulum and two papillalike gonotyls are present. Other characters are similar in members of these genera and such variations as are present are regarded as of specific value. It is the opinion of the writer, therefore, that all the above-named genera should be reduced to two, namely, *Cryptocotyle* (syns. *Tocotrema* and *Ciureana*) and *Apophallus* (syns. *Rossicotrema* and *Cotylophallus*). To the first of these genera, *Cryptocotyle*, the following species are referred: *C. concava* (Creplin), *C. lingua* (Creplin), *C. jejuna* (Nicoll), *C. quinqueangulare* (Skrjabin), *C. cryptocotylodes* (Issaichikoff), and *C. echinata* (von Linstow); and to the second genus, *Apophallus*, the following species: *A. mühlengi* (Jägerskiöld), *A. donicum* (Skrjabin and Lindtrop) (syns. *C. venustus* and *C. similis*), *A. brevis* Ransom, and *A. crami*, new species.

The following generic diagnoses, to which are appended keys to species, represent the writer's conception of the two genera:



Genus *CRYPTOCOTYLE* Lühe, 1899

*Synonyms*.—*Tocotrema* Looss, 1899; *Hallum* WIGDOR, 1918; *Ciureana* SKRJABIN, 1923.

*Generic diagnosis*.—Heterophyidae: Body ovoid to linguiform in shape. Prepharynx very short; esophagus short; intestinal bifurcation nearer to oral sucker than to acetabulum; intestinal ceca slender, extending into posterior end of body and terminating caudad of testes. Acetabulum rudimentary, in anterior wall of the spacious, more or less muscular, genital sinus; genital ducts open into sinus at base of a single papilliform gonotyl; genital aperture postacetabular, in center of genital sinus. Seminal vesicle well developed, curved in a more or less S-like manner, dorsal to uterine coils. Testes near posterior end of body, irregularly oval or slightly lobed, either side by side or right testis obliquely behind left. Ovary irregularly oval or lobed, situated to right of median line and cephalad of seminal receptacle. Vitellaria fill postcecal space and extend anteriorly to acetabulum or beyond. Uterus with few loops, confined to intercecal space between ovary and genital sinus.

*Type species*.—*Cryptocotyle concava* (Creplin, 1825) Fiscoeder, 1903.

KEY TO SPECIES OF *CRYPTOCOTYLE*

1. Vitellaria extend to level of intestinal bifurcation or beyond;  
eggs reniform..... 2  
Vitellaria do not extend to intestinal bifurcation; eggs ovoid..... 3
2. Vitellaria extend to anterior end of esophagus; ovary not lobed;  
genital sinus 60 $\mu$  wide; eggs 38 $\mu$  by 15 $\mu$ .....quinqueangulare  
Vitellaria extend to near level of intestinal bifurcation; ovary  
lobed; genital sinus 127 $\mu$  to 159 $\mu$  wide; eggs 40 $\mu$  by 20 $\mu$ .  
cryptocotyloides
3. Vitellaria extend to level of, or slightly cephalad of, acetabulum..... 4  
Vitellaria extend about one-half the distance between acetabulum and intestinal bifurcation..... 5
4. Genital sinus 55 $\mu$  in diameter; eggs 31 $\mu$  to 36 $\mu$  by 16 $\mu$  to 19 $\mu$ .....jejuna  
Genital sinus about 280 $\mu$  wide; eggs 52 $\mu$  by 25 $\mu$ .....echinata
5. Body usually ovoid in shape, with testes placed side by side;  
eggs 34 $\mu$  to 38 $\mu$  by 16 $\mu$  to 20 $\mu$ .....concava  
Body usually linguiform in shape, with testes placed obliquely;  
eggs 40 $\mu$  to 50 $\mu$  by 18 $\mu$  to 25 $\mu$ .....lingua

Genus *APOPHALLUS* Lühe, 1909

*Synonyms*.—*Rossicotrema* Skrzabin and Lindtrop, 1919; *Cotyllophallus* Ransom, 1920.

*Generic diagnosis*.—Heterophyidae: Body ovoid to very elongated in shape. Prepharynx short; esophagus long; intestinal bifurcation usually nearer to acetabulum than to oral sucker; intestinal ceca slender, terminating as in *Cryptocotyle*. Acetabulum relatively well

developed, opening into a small, nonmuscular genital sinus; genital ducts open into genital sinus at base of two papilliform gonotyls; genital pore cephalad of acetabulum. Seminal vesicle well developed, **C** or **S** shaped, dorsal to uterine coils. Testes ovoid or globular, situated near posterior end of body, the right testis usually behind left. Ovary ovoid or globular, situated to right of median line cephalad of seminal receptacle. Vitellaria fill post-testicular space and extend usually to acetabulum or beyond. Uterus as in *Cryptocotyle*.

*Type species.*—*Apophallus mühlingi* (Jägerskiöld, 1899) Lühe, 1909.

#### KEY TO SPECIES OF APOPHALLUS

1. Body elongated, with more or less distinct constriction between acetabulum and bifurcation of intestine----- **2**  
     Body ovoid or elongated piriform in shape----- **3**
2. Vitellaria extend to level of acetabulum; intestinal bifurcation about one-third of body length from anterior end----- **mühlingi**  
     Vitellaria do not extend anteriorly as far as acetabulum; intestinal bifurcation about one-fifth of body length from anterior end----- **crami**
3. Body ovoid in shape; vitellaria extend to level of intestinal bifurcation or slightly beyond----- **donicum**  
     Body elongated piriform in shape; vitellaria extend only slightly beyond acetabulum----- **brevis**

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## TWO NEW LUNGWORMS FROM NORTH AMERICA RUMINANTS AND A NOTE ON THE LUNGWORMS OF SHEEP IN THE UNITED STATES

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Early in 1930 some sections from the lungs of a mountain sheep (*Ovis canadensis*) from Pikes Peak, Colo., were sent to the Zoological Division by Dr. George W. Stiles, of the Denver Pathological Laboratory of the Bureau of Animal Industry, with the information that a number of these sheep had died as a result of lungworm infestation. Macroscopically the lesions in the lungs presented an appearance similar to that found in sheep lungs infected with *Muellierius capillaris*. Microscopic examination demonstrated that the lungworms present belong to a species not previously described. It is, therefore, here described as a new species.

Owing to their location in the parenchyma of the lungs and the difficulty involved in their removal from the tissues, no entire specimens were collected. The largest single piece obtained was part of a male, the fragment measuring 8 millimeters in length.

**PROTOSTRONGYLUS STILESII, new species**

### PLATE 1

*Specific diagnosis.*—*Protostrongylus*: *Male*: Length uncertain, but more than 8 mm.; width,  $150\mu$  to  $160\mu$  immediately in front of the bursa. The esophagus is  $235\mu$  to  $270\mu$  long by  $50\mu$  wide at its base, where it narrows in joining the intestine.

The spicules are equal and are  $300\mu$  to  $340\mu$  long; the spicular sheath begins about  $50\mu$  to  $60\mu$  from the proximal end and extends to well below the distal termination of the spicules; the sheath is supported by a series of digitations, which reach a length of about  $23\mu$  in the widest portion of the sheath. The digitations extend to about  $40\mu$  from the distal end of the spicules. The telamon roughly

approaches the letter H in shape. Contrary to the condition described as occurring in *Protostrongylus rufescens*, the proximal part of this structure, while not so deeply pigmented as the distal part, has a distinct yellowish-brown coloration, which makes it quite noticeable in cleared specimens. This part of the telamon is  $58\mu$  long. The ventral part of the telamon consists of two deeply colored rods, joined at their upper ends and with boot-shaped terminations; the toe of the "boot" is very sharp in some specimens, in others there seems to be a solid chitinous structure from the instep to the toe so that the termination appears to be triangular; this part of the telamon is  $96\mu$  long. The gubernaculum is an arc-shaped structure with its convexity directed toward the head end; there are two sharp prolongations on the dorsal side, and on the ventral side the gubernaculum has the shape of a plate with a convex semi-circular edge. The bursa is short. The ventral rays are united for the greater part of their length. As in other members of the Protostrongylidae the other rays are somewhat modified. The externo-dorsals are slender and do not reach the margin of the bursa. The dorsal ray is represented by a solid spherical body, which bears a series of five papillae on its ventral surface. The chitinous arcs described and figured for other members of this genus are present.

*Female*: Length uncertain; width, about  $100\mu$  in the region of the vagina. The body terminates in an acute point. The distance from the anus to the tip of the tail is  $67\mu$  to  $75\mu$ , and from the anus to the vulva  $190\mu$  to  $200\mu$ . The vulva is covered by a backward-projecting cuticular flap, which forms the provagina mentioned in descriptions of other members of this genus. There is a knoblike enlargement immediately posterior to the vulva. The vagina is about  $475\mu$  long. The eggs in the vagina are  $85\mu$  to  $90\mu$  long by  $30\mu$  to  $38.5\mu$  wide.

*Host*.—Mountain sheep (*Ovis canadensis*).

*Location*.—Lungs.

*Locality*.—Pikes Peak, Colo.

*Type specimen*.—U.S.N.M. Helm. Coll. No. 29379.

This species is named for Dr. George W. Stiles, who collected the material.

During the early part of 1930, the Bureau of Animal Industry was informed that the deer and elk in the Yellowstone Park, Wyo., were suffering from lungworm disease, and lungworms collected on post-mortem examination by Dr. H. B. Raffensperger, of Miles City, Mont., were forwarded for study. The nematodes collected from the lungs of the elk were identified as *Dictyocaulus hadweni*, but those from the deer proved to be a new species of *Protostrongylus*.

## PROTOSTRONGYLUS MACROTIS, new species

## PLATE 2

*Specific diagnosis.*—*Protostrongylus*: *Male*: 26 mm. long and  $165\mu$  wide. Immediately anterior to the bursa the body narrows to about  $95\mu$  to  $100\mu$ . The esophagus is  $440\mu$  long and  $77\mu$  wide at its base. The spicules are  $200\mu$  long. The spicule sheath extends from the proximal end of the spicule to within about  $10\mu$  to  $15\mu$  from the distal end. The telamon is usually situated immediately behind the terminal portion of the spicules and is difficult to study. In its general pattern it resembles similar structures figured for other members of this genus. It terminates in two sharply curved, acute points. There is no gubernaculum. The bursa when spread out is  $180\mu$  to  $190\mu$  wide and about  $160\mu$  long. The ventro-ventral ray is  $25\mu$  to  $27\mu$  long, the ventro-lateral  $37\mu$ , the externo-lateral  $35\mu$ , the medio-lateral  $46\mu$ , the postero-lateral  $44\mu$ , and the externo-dorsal  $38.5\mu$  to  $42\mu$ . Chitinous arcs are present.

*Female*: 45 mm. to 47 mm. long by  $190\mu$  to  $200\mu$  wide in the region of the vulva. The two uteri unite to form a vagina, which is  $575\mu$  to  $600\mu$  long. The distance from the vulva to the anus is 250 to  $260\mu$ , and from anus to the tip of the tail  $110\mu$  to  $120\mu$ . The tail ends in a bluntly rounded point. The eggs in the terminal portion of the uteri are from  $57\mu$  to  $65\mu$  long by  $38.5\mu$  wide.

*Host.*—Mule deer (*Odocoileus hemionus hemionus*).

*Location.*—Bronchi.

*Locality.*—Yellowstone Park, Wyo.

*Type specimen.*—U.S.N.M. Helm. Coll. No. 30406.

## A NOTE ON THE LUNGWORMS OF SHEEP IN THE UNITED STATES

Curtice, in 1890, records the occurrence of two lungworms in sheep in the United States. He named one "the hair lungworm, *Strongylus ovis pulmonalis* Diesing" and the other "the thread lungworm, *Strongylus filaria* Rud." Hall considered *Strongylus ovis pulmonalis* as identical with *Synthetocaulus rufescens* and placed Curtice's name for the hair lungworm in synonymy. A cursory examination of some of the material in the United States National Museum collection labeled *Synthetocaulus rufescens* has shown that part of the material so labeled is in reality *Muellerius capillaris* Cameron, 1927. Examination of material macroscopically similar to that described by Curtice, obtained from a sheep at Washington, D. C., also demonstrated that the worms present were *Muellerius capillaris*. Nematodes found in the bronchi of the same animal

were identified as *Dictyocaulus filaria*. *Protostrongylus rufescens* has so far not been found in an examination of material collected from sheep in the United States. Further investigations of ruminant lungworms are desirable to ascertain which species occur in this country.

A PROVISIONAL KEY TO THE SPECIES OF *PROTOSTRONGYLUS*<sup>1</sup>

1. Provagina and gubernaculum present-----*stilesi*  
     Provagina present and gubernaculum absent, or provagina  
     absent and gubernaculum present, or both provagina and  
     gubernaculum absent-----2
2. Provagina present and gubernaculum absent-----*sagittatus*  
     No provagina present-----3
3. Gubernaculum absent-----*macrotis*  
     Gubernaculum present-----4
4. Distal parts of telamon straight, with inner margins serrated.  
     Spicules 260 $\mu$  long; telamon 60 $\mu$  long-----*rufescens*  
     Distal part of telamon boot-shaped with inner margins smooth-----5
5. Spicules 260 $\mu$  long; telamon 40 $\mu$  long-----*ocreatus*
6. Spicules 160 $\mu$  to 170 $\mu$  long; telamon 33 $\mu$  long-----*commutatus*

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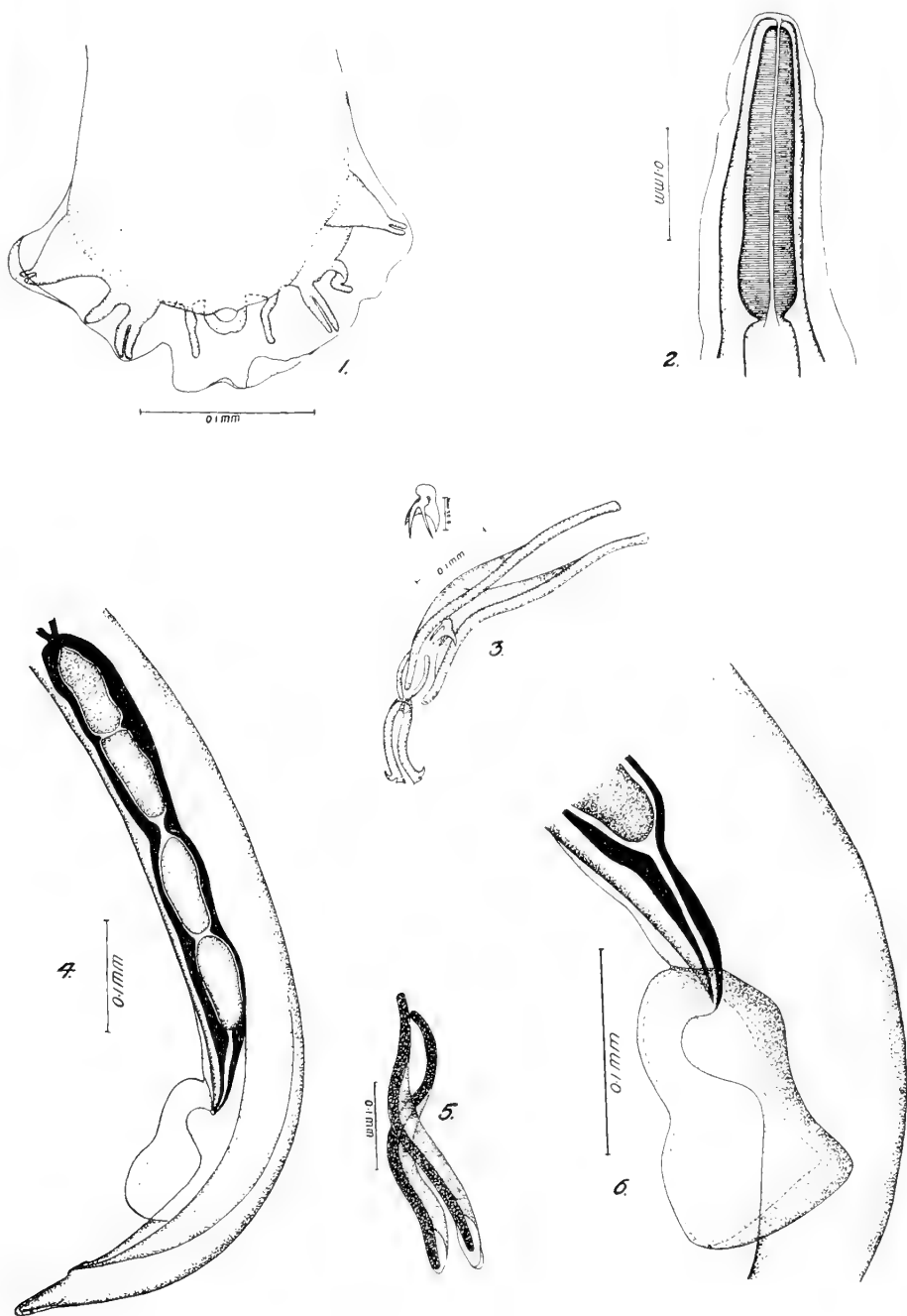
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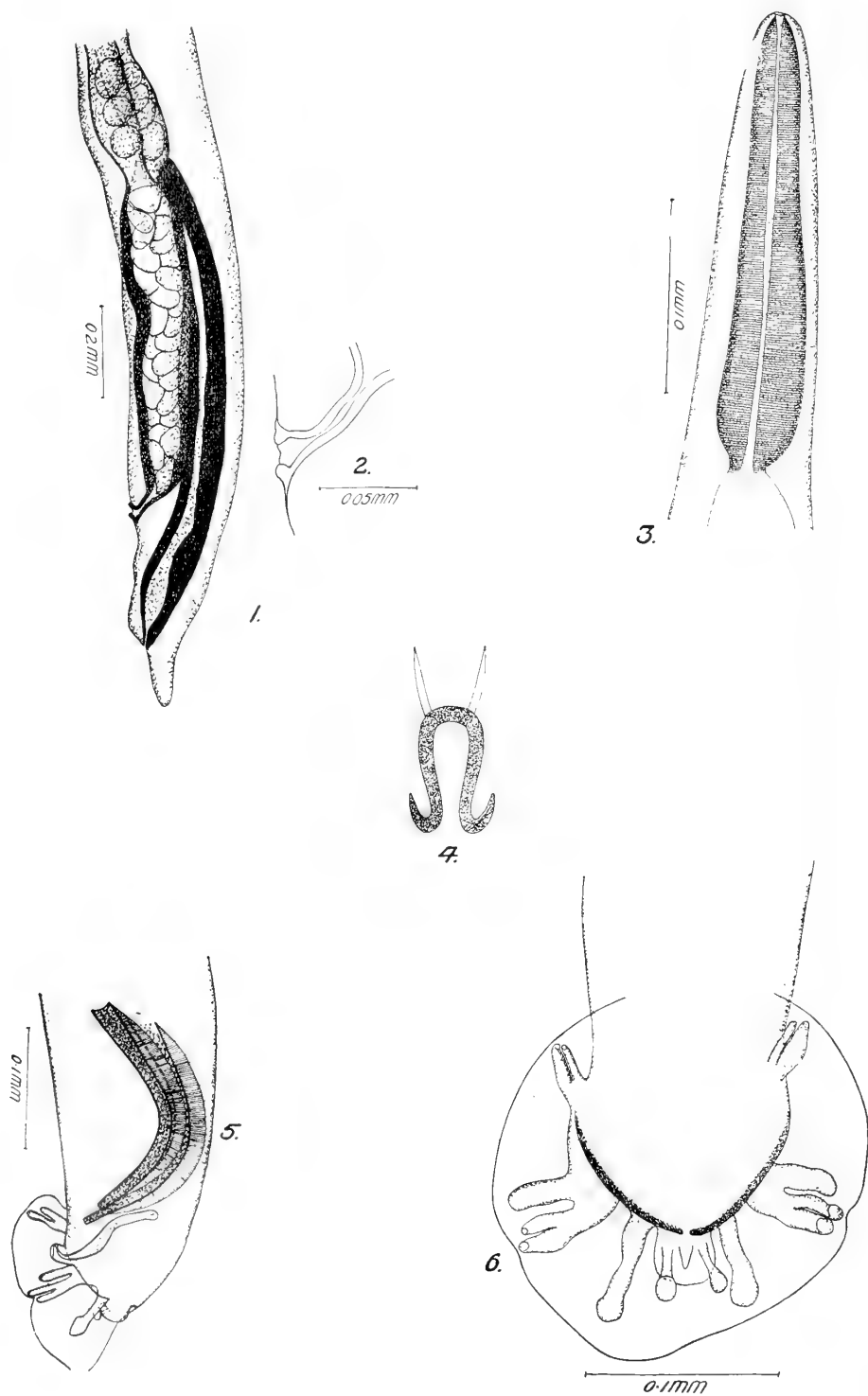
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<sup>1</sup> Owing to the absence of sufficient data, *Protostrongylus unciphorus* (Railliet and Henry, 1907), can not now be included in any key.



*PROTOSTRONGYLUS STILESII*

- 1, Bursa of male; 2, esophagus; 3, spicules, gubernaculum, and telamon; 4, tail end of female; 5, spicules;  
 6, vulva and provagina of female



*PROTOSTRONGYLUS MACROTIS*

- 1, Tail end of female; 2, vulva; 3, esophagus; 4, telamon (diagrammatic); 5, tail end of male; 6, bursa of male



# A NEW GENUS AND NEW SPECIES OF TREMATODE WORMS OF THE FAMILY PLAGIORCHIIDAE

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In 1927, while a student at the University of Washington, the writer collected about 10 flukes from the intestines of frogs (*Rana pretiosa*). Owing to the lack of adequate library facilities, a description of these parasites, which are regarded as representing a new genus and new species of the family Plagiorchiidae, could not be completed until the writer came to Washington, D. C. A survey of the literature has now made it possible to complete the study of these trematodes and to determine their systematic position. The writer takes pleasure in acknowledging his indebtedness to his associates in the Zoological Division of the Bureau of Animal Industry for helpful suggestions. The host determination was made by members of the staff of the Department of Zoology in the University of Washington.

## HAPLOMETRANA, new genus

*Generic diagnosis.*—Plagiorchiinae: Slender worms, flattened dorsoventrally, and bluntly rounded at both extremities. Esophagus long and slender. Intestinal ceca long, extending from the bifurcation almost to the posterior extremity of the body. The moderately long, slender cirrus pouch extends posterior to the acetabulum and curves about it anteriorly. A saclike seminal vesicle occupies approximately the posterior half of the cirrus pouch, anterior to which are the narrow prostate duct and the ejaculatory duct. The cirrus is protrusible.

*Haplometrana* may be distinguished from other genera of the subfamily Plagiorchiinae by the possession of a definite combination of characters. The testes are tandem and in the median line. The ovary is approximately median in position, and a seminal receptacle is present. Neither the descending ramus nor the ascending ramus of the uterus passes between the testes. Both branches of the uterus are normally ventral to the testes, and the ascending ramus usually

passes under the ventral surfaces of the ovary and seminal receptacle. The seminal receptacle is just posterior to the ovary and nearly median. The vitellaria are lateral, occur in unorganized chains of follicles, and extend from about the level of the acetabulum posteriorly to a point about halfway between the posterior testis and the posterior end of the body.

*Type species.*—*Haplometrana intestinalis*, new species.

HAPLOMETRANA INTESTINALIS, new species

*Description.*—*Haplometrana*: Rather small, slender distomes, of somewhat variable length and width. Mature specimens are about 5 mm. long and 0.48 mm. to 0.63 mm. in maximum width; thus, the length is about eight to ten times the maximum width. There is no constriction between the anterior and posterior portions of the body (pl. 1, fig. 1). The cuticle is spinous, especially in the anterior region.

The oral sucker is about 0.256 mm. to 0.32 mm. in diameter; it is larger than the acetabulum and subterminal in position. The acetabulum is about 0.176 mm. to 0.24 mm. in diameter and is situated in the anterior sixth of the body length. The suckorial disk of the acetabulum is continued dorsally as a cone-shaped mass of muscular tissue.

The muscular pharynx is preceded by a short prepharynx. The former is 0.11 mm. to 0.14 mm. wide and 0.08 mm. to 0.10 mm. long, is nearly contiguous to the oral sucker, and is roughly one-half its size. The esophagus is long and very slender. The intestinal ceca are lateral in position, extending posteriorly from the bifurcation to a point within a short distance from the posterior tip of the body. In some specimens the ceca are of unequal length.

Since it was impossible to study the specimens in the living state, the precise structure of the excretory system can not be described. One stained specimen shows paired saclike bladders extending anteriorly beyond the intestinal bifurcation, similar to those described by Looss for *Haplometra cylindrica*. These branches of the Y reach nearly to the oral sucker. The excretory pore is terminal.

The genital pore is anterior to the acetabulum and median, or nearly median, in position. The cirrus pouch is slender and curls about the suckorial disk of the acetabulum. (Pl. 1, fig. 2.) It is found either to the left or to the right of the disk. The testes are tandem and median; they occupy all, or nearly all, the intercecal space and in some specimens are partially superimposed upon the ceca laterally. Usually the testes are separated from each other by a distance somewhat less than their diameter. The posterior margin of the posterior testis marks the approximate equator of the body. The diameter of the testes is about 0.32 mm. to 0.368 mm. In the specimens

in which the vas efferens may be traced anteriorly, the position of these ducts varies considerably. In one specimen the duct of the posterior testis passes anteriorly between the intestinal ceca and anterior testis on the left and turns transversely to the right just posterior to the transverse vitelline duct. On the right it joins the vas efferens from the anterior testis and from this point proceeds as the vas deferens to the seminal vesicle. Shortly before the cirrus pouch is reached a small sac or reservoir is formed. (Pl. 1, fig. 2.)

The seminal vesicle is bulky and rather long, occupying the posterior half of the slender cirrus pouch. Anterior to it are the narrow prostate canal, the ejaculatory duct, and the protrusible cirrus. (Pl. 1, fig. 3.)

The ovary is located immediately caudad to the posterior border of the cirrus pouch, a short distance posterior to the acetabulum, and immediately anterior to the seminal receptacle. The diameter of the ovary is about 0.22 mm. to 0.24 mm.

A rather large and definite seminal receptacle is present, anterior to the anterior testis, from which it is separated by the transverse vitelline duct, and immediately posterior to the ovary.

The uterus is extensive, filling the posterior half of the body. It extends from the termination of the short oviduct posteriorly and ventrally, under the ventral surfaces of the testes to the posterior tip of the body, and then returns anteriorly to the genital pore. Both the descending and ascending portions are coiled transversely and are folded upon themselves. The coils of the uterus are slender, except perhaps posteriorly, where no definite form is discernible. It is to be noted that the uterus passes not between the testes but under their ventral surfaces. The ascending ramus also passes ventrally beneath the seminal receptacle, ovary, and cirrus pouch.

The vitellaria are distinct follicles, disposed in lateral chains, and extend from near the posterior edge of the ovary to a point about one-fifth of the body length from the posterior tip of the body. There is no pattern or definite organization of the follicles. The juncture of the oviduct, the vitelline duct, and the duct of the seminal receptacle is variable in position, but usually these ducts unite in close proximity to the ovary and seminal receptacle. (Pl. 1, fig. 4.) Laurer's canal is present and communicates directly with the seminal receptacle. The yolk reservoir is variable in position but is located somewhere along the transverse vitelline duct and near the median line.

The fully formed eggs are brownish yellow and about 0.048 mm. to 0.058 mm. long and 0.018 mm. to 0.026 mm. wide. Those observed in the initial portion of the descending ramus are transparent and colorless.

*Host*.—*Rana pretiosa*.

*Location*.—Intestine.

*Locality*.—United States (Bothell, Wash.)

*Type specimen*.—U.S.N.M. Helm. Coll. No. 29903; paratypes, U.S.N.M. Helm. Coll. No. 29904.

#### SYSTEMATIC POSITION OF HAPLOMETRANA INTESTINALIS

The family Plagiorchiidae Lühe, 1901, has been frequently subdivided and revised by various parasitologists. The most recent revision, and one that is based upon extensive studies pertaining to many of the genera concerned, is that of Travassos (1928). His six subfamilies represent a conciliation of his own studies and views with those of Baer (1924) and Poche (1926), and are as follows: Plagiorchiinae Pratt, 1902; Brachycoeliinae Looss, 1900; Saphaodrinae Baer, 1924; Reniferinae Pratt, 1902; Prosthogoniminae Lühe, 1909; and Opisthogoniminae Travassos, 1928.

Travassos evidently prefers to accept Pratt's (1902) diagnosis of the subfamily Plagiorchiinae rather than that of Looss (1899), which was accepted by Baer (1924). The former allows somewhat greater latitude, and 22 genera are placed in this group by Travassos. Pratt's key was devised to include only North American forms; however, from a study of it the following diagnosis may be given:

#### Subfamily PLAGIORCHIINAE Pratt, 1902

*Subfamily diagnosis*.—Plagiorchiidae: Hermaphroditic distomes in which the acetabulum is median and ventral. The ovary is anterior to the testes. The uterus usually extends posterior to the testes and usually reaches the posterior end of the body. The intestinal ceca are long, extending more than one-half the body length. The ovary is usually located immediately behind the acetabulum or beside it. The genital pore is near the acetabulum or in front of it. There are no papillae or projections surrounding the oral aperture. The intestinal ceca usually do not reach the posterior end of the body. The cuticle is usually spiny. The excretory canal or bladder is usually Y shaped. A cirrus sac is present. The esophagus is long or lacking. The cirrus pouch extends posteriorly to, or beyond, the acetabulum. The extent of the vitellaria is variable. The position of the testes with relation to each other is variable.

With reference to the characters of the Plagiorchiinae, agreement seems to be general upon one point, namely, that the subfamily displays the typical anatomy of the family. The remaining subfamilies possess more or less distinct, divergent characters.

The writer has reviewed descriptions and illustrations pertaining to the 22 genera credited to the subfamily Plagiorchiinae by Travassos, particularly with reference to the 9 genera comprising the "A"

group, which most typically represent it, in the opinion of Travassos. Of all these genera, *Haplometra* as defined by Odhner, is most closely related to the proposed new genus *Haplometrana*; on the basis of the existing generic conceptions within the subfamily, the creation of a new genus for the new species from *Rana pretiosa* is justified and necessary.

The fact that some of the genera of Plagiorchiinae are extremely closely related morphologically is generally recognized. The characters that distinguish the earlier genera, especially those of Looss, Lühe, and Odhner, should, it is believed, be accepted for the present as a guide, at least until the need for an adequate revision of the group is fulfilled.

The writer believes that the validity of the proposed new genus *Haplometrana* depends only upon the demonstration of its distinction from *Haplometra*; for, as will be shown, the latter genus shares with *Haplometrana*, to a degree, certain characters that distinguish both from all other genera of the subfamily.

According to Odhner (1911), Looss concluded that the tandem position of the testes in *Haplometra cylindrica* Looss was to be regarded as an abnormality, and the oblique position stands in his generic diagnosis. Looss also states that the uterus passes between the testes. On the basis of observations upon some 30 specimens of *Haplometra cylindrica*, Odhner (1911) maintains that the tandem position of the testes must be regarded as normal for this genus, and he points out emphatically that the uterus does not pass between the testes but under them. That Odhner's observations are correct is supported by a recent publication of Travassos (1930), who describes specific variations of *Haplometra cylindrica*. Odhner regards *Haplometra* as related to, and derived from, *Lepoderma* (synonym of *Plagiorchis*). He concludes that the modifications that *Haplometra* exhibits follow as a natural result of its topography. He therefore regards these features, which must be admitted as atypical for the subfamily, as comprising a basis entirely adequate for the validity of the genus.

In *Haplometrana intestinalis*, owing to the still greater diameter of the testes as compared with the body width, a tandem and median position of the testes becomes the only possibility. As a result of this morphological feature, the passage of the uterus between the testes is rendered a physical impossibility. Dorsoventral passage of the uterus between the testes is a theoretical possibility but has not been observed. The new generic conception is based essentially upon these facts.

If Odhner's emended concept of the genus *Haplometra* is accepted, *Haplometrana* is distinguished from *Haplometra* principally by the possession of a definite seminal receptacle. Moreover, in *Haplo-*

*metrana* the vitellaria do not extend anterior to the acetabulum. The uterus is transversely coiled and narrow. The intestinal ceca do not extend to the posterior tip of the body. If the original diagnosis of Looss (1899) is accepted, the distinction between the two genera is even more marked.

The genus *Opisthioglyphe* Looss also exhibits an aberrant morphology, in that the uterus does not pass between the testes. In this genus, however, the uterus is confined to the space between the acetabulum and the middle of the anterior testis. The testes are usually oblique but may be tandem, and they are usually located well back in the posterior portion of the body. Typically, the cirrus pouch is entirely, or mostly, anterior to the acetabulum. The vitellaria extend to the posterior tip of the body.

Concerning the separation of the testes by the uterus in the genus *Mediorima* Nicoll, 1914, no definite statement can be made, since this genus is inadequately described. Travassos includes it in the Plagiorchiinae. Sumwalt (1926) expresses the opinion that the establishment of the genus *Mediorima* seems unnecessary. *Mediorima* appears to be so closely related to *Zeugorchis* Stafford, 1905, and *Lechriorchis* Stafford, 1905, both of which belong to the subfamily Reniferinae Pratt, 1902, that its inclusion in the Plagiorchiinae appears dubious.

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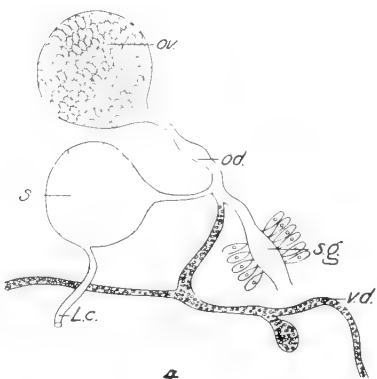
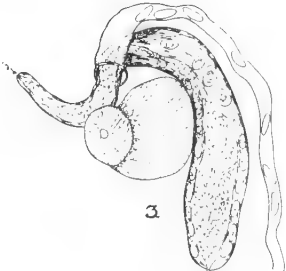
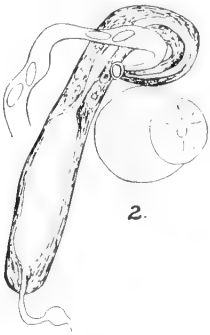
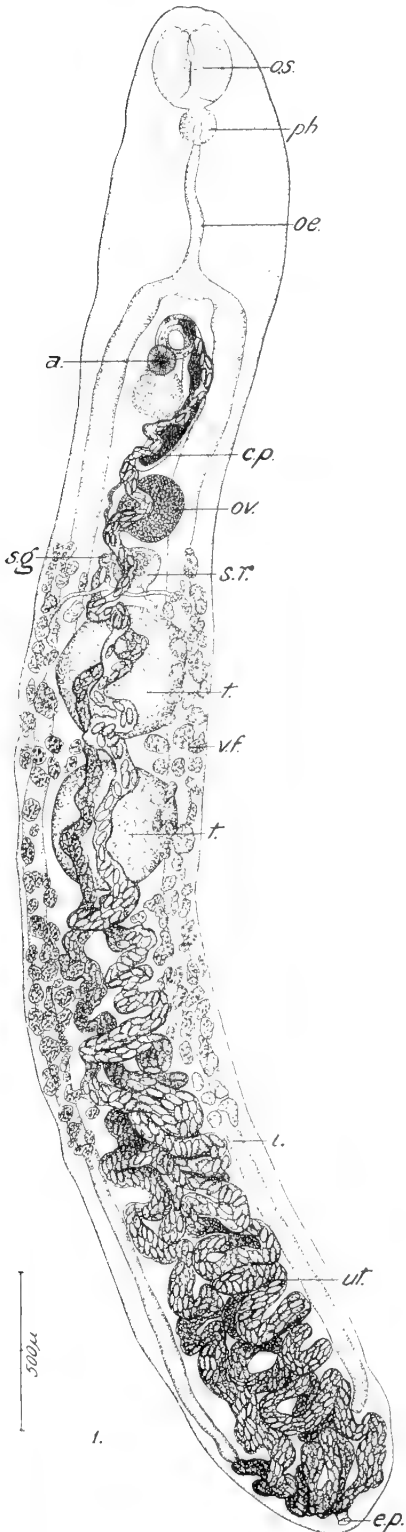
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#### EXPLANATION OF PLATE 1

**FIGURE 1.** Camera lucida drawing of ventral view of a stained specimen: *o. s.*, Oral sucker; *ph.*, pharynx; *oe.*, esophagus; *a.*, acetabulum; *c. p.*, cirrus pouch; *ov.*, ovary; *s. r.* seminal receptacle; *s. g.*, shell gland; *t.*, testis; *v. f.*, vitelline follicle; *i.*, intestine; *ut.*, uterus; *e. p.*, excretory pore.

2. Normal position of the cirrus pouch and end ducts of the reproductive system.
3. Cirrus pouch showing the cirrus protruding from the genital pore.
4. Diagrammatic representation of the relationships of the female reproductive organs: *ov.*, ovary; *o. d.*, oviduct; *s.*, seminal receptacle; *L. c.*, Laurer's canal; *v. d.*, transverse vitelline duct; *s. g.*, shell gland.





HAPLOMETRANA INTESTINALIS, NEW GENUS, NEW SPECIES

FOR EXPLANATION OF PLATE SEE PAGE 8



# REVISION OF THE AMERICAN PARASITIC FLIES BELONGING TO THE GENUS *WINTHEMIA*

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Parasitic flies of the genus *Winthemia* are perhaps more often reared in economic work than any other species of Tachinidae. Coquillett in 1897<sup>1</sup> recognized four species from America north of Mexico, and hitherto no comprehensive work on the genus has been published. The present paper contains descriptions of 32 species, of which 16 are new to science. In the preparation of this paper I have studied the material contained in the United States National Museum, which includes the types or specimens compared with types of practically all the previously described American forms.

I am greatly indebted to Dr. J. M. Aldrich, associate curator of the division of insects, for placing the facilities of the United States National Museum at my disposal, and for numerous other favors, particularly for the use of his notes on the types of several American species in European museums, which have proved invaluable in clearing up uncertainties that otherwise could not have been elucidated. Acknowledgment is gratefully made also to A. B. Conner, director of the Texas Agricultural Experiment Station, and to the United States Bureau of Entomology for providing an opportunity to conduct this study, and to Charles T. Greene for preparing the drawings herein included. I am under obligation to C. Howard Curran for the privilege of examining the material contained in the American Museum of Natural History, including two undescribed forms for which credit is given under each species. My thanks are due the late Prof. James S. Hine and also to Dr. Charles Robertson, Dr. T. H. Frison, Colbran J. Wainwright, and Ray T. Webber, who generously loaned material for study. Determined specimens of *Winthemia quadripustulata* received from the eminent European authority, Dr. J. Villeneuve, have been very useful in making determinations of our American forms.

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<sup>1</sup> U. S. Dept. Agr., Bur. Ent., Tech. Ser. No. 7, pp. 124-125, 1897.

Genus *WINTHEMIA* Robineau-Desvoidy

- Winthemia* ROBINEAU-DESVOIDY, Myodaires, p. 173, 1830. [Type, *Musca variegata* Fabricius, originally included, by designation of Robineau-Desvoidy, Dipt. Env. Paris, vol. 1, p. 207, 1863. Although *M. variegata* was not described by Fabricius but as *Tachina variegata* (Syst. Reschr., vol. 4, p. 256, 1824), Robineau-Desvoidy in 1830 and 1863 included the reference to *Tachina variegata* Meigen, leaving no doubt as to the species intended. But since *Tachina variegata* Meigen equals *Musca quadripustulata* Fabricius (Stein, Aus. Nachr., vol. 26, p. 150, 1900), the latter, also an originally included species, becomes the genotype.]—COQUILLETT, Revis. Tachin., p. 124, 1897.—ALDRICH, Catalogue, p. 473, 1905.—ADAMS, in Williston's North Amer. Dipt., p. 375, 1908.—TOTHILL, Can. Ent., vol. 44, p. 1, 1912.
- Microtrichodes* MACQUART, Dipt. Exot., suppl. 1, p. 288, 1846. [Type designated, *analis*, new species. I have not seen the type.]
- Masipoda* BRAUER and BERGENSTAMM, Zweifl. Kais. Mus., vol. 4, p. 162, 1889. [Type designated, *geminata*, new species. Not examined by the writer.]
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- Okea* TOWNSEND, Ins. Insc. Menst., vol. 4, p. 74, 1916. [Type designated, *Winthemia okefenokeensis* Smith. I have examined the type.]
- Neowinthemia* TOWNSEND, Proc. U. S. Nat. Mus., vol. 56, p. 583, 1919. [Type designated, *abdominalis*, new species. I have examined the type specimen.]
- Nemosturmia* TOWNSEND, Ins. Insc. Menst., vol. 14, p. 34, 1926. [Type designated, *pilosa*, new species. Equals *Winthemia fumiferanae* Tothill, according to Aldrich, Bull. Brooklyn Ent. Soc., vol. 22, p. 24, 1927; subsequently verified from the type by Doctor Aldrich in correspondence.]
- Hemimasipoda* TOWNSEND, Revista Museu Paulista, vol. 15, p. 267, 1926. [Type designated, *brasiliensis*, new species. Equals *Winthemia pinguis* Fabricius. I have examined a type specimen.]

In submitting the above synonymy I should point out that there is no type specimen of *quadripustulata* in existence, and it is only in a traditional sense that the name *Winthemia* can be used at all. I have accepted Dr. J. Villeneuve's determination for the species and deem it expedient to make no further attempt in obtaining a name based upon an unquestioned genotype. The ultimate solution of this problem rests with European dipterists. Since the name is accepted by them, it appears logical for us to concur; although we are employing a name here that is open to question, we have the consolation of retaining a well-known and a long-used name that is almost as old as the science of dipterology itself.

The American species of *Winthemia* are strikingly uniform in most of their characters, and even those forms that show specializations in the structure of the fore tarsi are well within the range of the rest of the genus. The latter is fully recharacterized below from the type species *quadripustulata*, as determined by Dr. J. Villeneuve. On the following pages an attempt has been made to characterize adequately each American species to distinguish it from *quadripustulata* and the other known forms without the profitless repetition of all details identical with the type species.

*Generic characters* (from the type species).—Head wider than high, the length at vibrissae shorter than at antennae, posterior surface flattened or but slightly bulging below. Eyes densely hairy, in profile extending below level of vibrissae. Antennae inserted above middle of eye, third joint one and one-half times the length of second; arista bare, a little longer than antennae, with short but distinct basal joints. Face somewhat receding, moderately excavated and slightly keeled; ridges bare except a few hairs at base; parafacials hairy. Oral cavity large, in profile the lower margin straight behind and sloping abruptly upward on about the anterior third; vibrissae somewhat approximated, situated near level with front border of oral margin but distinctly above the lower edge of head. Front rather prominent below, much narrowed above in male, not in female. Proboscis very short, stout, labella large and fleshy; palpi normal in size. Cheeks in profile one-seventh the eye height, thickly clothed with fine hairs. Frontal bristles in two rows, which diverge below base of antennae and extend to apex of the second joint, in male all bristles directed inward, becoming smaller above, stopping before triangle, in female the two uppermost larger and reclinate; verticals two pairs, outer ones small or hairlike in male; two pairs of orbitals in female, none in male; ocellar bristles present, proclinate, behind the ocellar triangle another pair, erect, and still another but wider-spaced pair behind these on the occiput. Posterior orbits moderately wide below, narrowed and almost linear above, the occipital fringe with some long hairs above the middle and only pale ones behind.

Thorax a little narrower than head, viewed from above distinctly longer than broad with the sides nearly parallel, suture well before middle; humeral and pleural hairs black, some with noticeable wavy tips. Chaetotaxy: Acrostichal, 3, 3; dorsocentral, 3, 4; humeral, 5; posthumeral, 2 or 3; notopleural, 2; presutural, 2; intraalar, 3 (none near suture); supraalar, 3; postalar, 2; mesopleural, 7 or 8 behind, 3 at lower front angle; propleural, 2; pteropleural, 1 (small); hypopleural, 6 to 8; sternopleural, 1, 1; scutellum with three lateral, one smaller decussate apical, and one discal pair. Postscutellum well developed; postnotum beneath calypter bare; prosternum with fine hairs at sides.

Abdomen short ovate and rather flattened; intermediate segments without discal bristles; first with a pair of median marginals; second also usually bearing one pair (sometimes two or more); third with a marginal row of about 10; fourth with two irregular rows near the apex. Male genitalia small and retracted, with the usual inner and outer forceps, the former united except near apex and keeled behind, the latter thin or flattened structures tapering outward from base.

Female with the genitalia terminating in a thick fleshy tubular ovipositor.

Legs rather slender; hind tibiae ciliate, usually with one longer bristle near middle; claws and pulvilli elongate in male, not in female.

Wings ordinary in shape; fourth vein without stump at bend, the last section curved inward; hind cross vein joining fourth much nearer bend than small cross vein; last section of fifth vein very short. First posterior cell open well before wing tip. Veins bare except a few hairs at base of third. Costal spine vestigial or absent.

*Specific characters.*—Our species separate into two groups in the male sex on the presence or absence of abdominal patches of matted hairs on the venter of the third or fourth tergites. I consider the patches present only when they are limited by a sharp or well-defined margin. Several species are intermediate in this respect, for example, in *deilephilae*, *cecropiae*, and *latevittata* the venter of the third and fourth abdominal segment at the center on either side is thickly pilose, but the hairs gradually become thinner and shorter outward from the middle and blend with the normal vestiture at the sides without any definite break or margin circumscribing the dense hairs. These and all similar forms are included in the series considered to have the patches absent.

The abdominal patches referred to are developed in a number of different ways seemingly constant within the species and offer several good characters of taxonomic value. Although the male genitalia are very similar in structure throughout the group, the shape and comparative length of the inner and outer forceps are quite distinctive for a number of species. The females offer even fewer characters than the males, and except in rare cases they can not always be separated with certainty or associated with the opposite sex. The width of the front in relation to the total head width, especially in the males where the greatest variations occur among species, and the length of the third antennal joint compared with the second, furnish serviceable characters for classification, although some variations must be anticipated. Thoracic chaetotaxy is quite too uniform to give any specific characters aside from a few cases, and I have omitted it almost entirely. Details of the frontal bristles and of the pollen on the front, face, and abdomen furnish additional points of some value in separating the species. The color pattern of the abdomen varies within some species and must be viewed with suspicion. The ciliation of the hind tibiae is developed in various degrees but is subject to sexual variation in the species. In the females the genitalia are identical in structure throughout consisting of a fleshy protractile blunt-tipped ovipositor.

The genus shows about the same combination of external characters as *Zenillia* Robineau-Desvoidy; in the latter, however, the parafacials are entirely bare and the genitalia are of a different type.

*Biology.*—As has already been stated, species of *Winthemia* are frequently encountered in economic work, and our literature of the past 30 years contains a list of several hundred rearing records from 40 or more different hosts. Unfortunately, several species have been confused under the name *quadripustulata* and a large majority of the reported rearings are subject to verification. Several authors have called attention to the importance of the so-called “red-tailed tachina fly” in controlling infestations of the army worm. It seems quite certain that this common army-worm parasite is not *quadripustulata*, as it has been commonly determined, but a distinct form rediscovered as *rufopicta* in the present paper. In the files of the United States National Museum there are several records of rearing *Winthemia*s from coleopterous larvae and adults, but the vast majority of the rearings are from lepidopterous larvae. So far as is known, the reproductive habits are the same in all the species. The females deposit flattened macrotype eggs on the body of the host. This is Pantel's first group, which includes *Nemorilla*, *Exorista*, etc.

### KEY TO SPECIES OF WINTHEMIA

MALES

- |    |  |                               |
|----|--|-------------------------------|
| 1. | Venter of abdomen without defined patches of dense hairs.....  | 2                             |
|    | Venter of abdomen with defined patches of dense hairs.....   | 18                            |
| 2. | Abdominal hairs long and erect.....  | 3                             |
|    | Abdominal hairs depressed, if erect not unusually long.....  | 6                             |
| 3. | Scutellum bearing three lateral bristles.....  | 4                             |
|    | Scutellum with only two lateral bristles; sides of front and face<br>plumbeous; ocellars weak or hairlike; third antennal joint<br>three times the length of second (California).  |                               |
|    | antennalis Coquillett (p. 10)  |                               |
| 4. | Legs wholly black or tibiae at most obscurely reddish.....   | 5                             |
|    | Tibiae pale yellow, the middle pair with two stout bristles near<br>middle on outer front side; abdomen densely gray pollinose<br>(? Massachusetts).....   | tibialis, new species (p. 11) |
| 5. | Sternopleurals three; uppermost frontals large, erect or reclinate;<br>front very narrow, 0.127 of the head width; abdomen<br>largely black, strongly tapering to apex, the hairs rather fine<br>and dense (Canada and United States, widespread). |                               |
|    | fumiferanae Tothill (p. 12)  |                               |
|    | Sternopleurals two; uppermost frontals reduced in size situated<br>before triangle; front 0.2 of the head width; abdomen distinctly<br>reddish on sides and apex, the hairs coarse (Europe,<br>New England to Washington, and New Mexico).         |                               |
|    | quadripustulata Fabricius (p. 14)  |                               |
| 6. | Prosternum with only fine hairs at sides.....  | 7                             |
|    | Prosternum bearing one or more bristles on either side; abdomen<br>largely reddish (North America, widespread).  |                               |
|    | deilephilae Osten Sacken (p. 33)   |                               |

7. Claws and pulvilli elongated----- 8  
 Claws and pulvilli not exceeding the length of last tarsal joint;  
 front fully three-fourths the width of eye; robust species  
 (Illinois)----- *cecropiae*, new species (p. 34)
8. Parafrontals yellow or golden pollinose----- 9  
 Parafrontals plumbeous or gray at most faintly tinged with  
 yellow----- 14
9. Mesonotum shining black, the stripes almost entirely obliterated----- 10  
 Mesonotum obviously pollinose, the black stripes distinct at  
 least before the suture----- 11
10. Abdomen with striking thick pale golden pollen extending  
 almost to the hind margins on the intermediate segments and  
 obscuring the red color on sides; palpi brownish or yellow at  
 tips (Virginia, Pennsylvania, Ohio)----- *abdominalis* Townsend (p. 23)  
 Abdomen distinctly reddish at sides; intermediate segments  
 thinly grayish pollinose beyond the narrow bases, the outer  
 hind corners of each broadly shining; palpi black or yellow  
 at tips (British Columbia)----- *occidentis*, new species (p. 22)
11. Thoracic stripes broadly separated by pollinose bands----- 12  
 Thoracic stripes more or less fused, appearing as two broad  
 black bands to the naked eye; intermediate abdominal seg-  
 ments covered with thin uniform bluish-gray pollen except on  
 narrow hind edge of each; palpi black on basal half, tips  
 yellow (Mexico)----- *latevittata* van der Wulp (p. 36)
12. Abdomen broadly reddish on sides----- 13  
 Sides of abdomen almost wholly black; fourth segment bright  
 orange-yellow, destitute of pollen and shining on apical three-  
 fourths; front prominent below; face strongly receding (Mani-  
 itoba, Canada)----- *borealis*, new species (p. 27)
13. Vibrissae distinctly above front edge of mouth; hairs on back of  
 head tinged with yellow above; parafacials rather thickly  
 haired; abdomen subshining, thinly gray pollinose, second  
 segment invariably without any median marginals; robust  
 species, length 10 to 14 mm. (New England to Mexico).  
*datanae* Townsend (p. 29)  
 Vibrissae on level with front edge of mouth; hairs on back of  
 head wholly pale-gray; parafacials sparsely haired; abdomen  
 thickly gray pollinose on basal half or more of last three  
 segments; length 6 to 8 mm. (New England to Iowa).  
*sinuata*, new species (p. 25)
14. Front one-half or more the width of eye----- 15  
 Front narrower----- 16
15. Parafrontals and face plumbeous; cheeks blackish, subshining,  
 very thinly gray pollinose; abdominal hairs erect or suberect;  
 palpi largely black (Mexico)----- *ignobilis* van der Wulp (p. 16)  
 Parafrontals pale grayish yellow; face and cheeks densely gray  
 pollinose; abdominal hairs wholly depressed; palpi yellow  
 (New Mexico)----- *duplicata*, new species (p. 17)
16. Outer genital forceps tapering outward to blunt rounded tips----- 17  
 Outer forceps hardly at all narrowed apically, the tips subtrun-  
 cate; parafrontals pale grayish yellow; mid tibiae with two  
 bristles on outer front side near middle (Texas).  
*texana*, new species (p. 19)



17. Cheek in profile almost linear; front greatly narrowed above 0.16 of the head width; parafacials inconspicuously haired; first and second abdominal segments usually without median marginals; mid tibiae with one bristle on outer front side near middle; abdominal hairs fine and depressed (North America, widespread)----- *rufopicta* Bigot (p. 31)
- Cheek in profile at least one-eighth the eye height; front approximating one-half the eye width; parafacials thickly haired; mid tibiae usually with two bristles on outer front side; abdominal hairs rather coarse and often erect or suberect (Europe, New England to New Mexico, and Washington)----- *quadripustulata* Fabricius (p. 14)
18. Intermediate joints of front tarsi conspicuously flattened and much broader than long----- 19
- Front tarsi ordinary----- 20
19. Palpi black; front exceeding one-half the width of eye; abdominal segments two and three with defined pollinose cross bands on basal half, the remainder shining black (Central and South America)----- *signata*, new species (p. 51)
- Palpi yellow; front greatly narrowed above and distinctly less than one-half the width of eye; intermediate abdominal segments pollinose or subpollinose to the hind margins (Georgia, Cuba)----- *okefenokeensis* Smith (p. 52)
20. Outer genital forceps subacute at apex or terminating in a curved hook----- 21
- Outer forceps truncate or symmetrically rounded at apex----- 23
21. Ocellar bristles present----- 22
- Ocellars absent; inner and outer genital forceps equal in length; the latter often with numerous long black hairs on outer side (Central and South America)----- *mima*, new species (p. 37)
22. Outer genital forceps tapering from base to tip; abdomen with the patches of matted hairs confined to the venter of third segment (Arizona)----- *montana*, new species (p. 36)
- Outer forceps narrowest at middle, the anterior extremity broadly produced; the patches of matted hairs on venter of third abdominal segment extending without interruption on base of fourth (Argentina)----- *singularis*, new species (p. 38)
23. Orbital bristles absent, claws and pulvilli elongate----- 24
- Orbitals present; claws and pulvilli minute (Mexico, Central and South America)----- *xanthocera* Wiedemann (p. 44)
24. Frontals in single rows with only fine hairs and small bristles outside--- 25
- Frontal bristles bordered by a partial secondary row outside of the main rows below (Bolivia)----- *analisis* Macquart (p. 47)
25. Uppermost frontal bristles stout, reclinate, situated almost on line with anterior ocellus----- 26
- Uppermost frontals small, situated at or before apex of ocellar triangle----- 27
26. Thoracic stripes fused, appearing as two broad black bands; face pale grayish-white (Mexico, Central and South America)----- *pinguis* Fabricius (p. 49)
- Thoracic stripes broad and very distinctly separated on entire length; face grayish yellow pollinose (Cuba)----- *sexualis* Curran (p. 47)

27. Abdomen pollinose or subpollinose to hind margins of intermediate segments----- 28  
 Abdomen with alternating white and black cross bands on last three segments; inner forceps narrow at base, uniform in width almost to the deeply incised apex, in profile thicker than usual and strongly bowed (Canal Zone)-- tricolor van der Wulp (p. 42)
28. Inner genital forceps very slender and but feebly keeled near base behind; outer forceps nearly equal the length of inner ones (North, Central, and South America).  
 intermedia, new species (p. 41)
- Inner forceps of ordinary width and sharply keeled behind on basal two-thirds; outer forceps about one-half the length of inner pair, triangular (Texas)----- imitator, new species (p. 39)

## FEMALES

1. Scutellum with three lateral bristles----- 3  
 Scutellum with only two lateral bristles----- 2
2. Parafrontals and face plumbeous; abdominal hairs erect; third antennal joint three times the length of second (California, New Mexico)----- antennalis Coquillett (p. 10)  
 Parafrontals and face covered with thick brassy or yellowish gray pollen; abdominal hairs depressed; third antennal joint one and one-half times as long as second (British Columbia).  
 intonsa, new species (p. 28)
3. Prosternum with only fine hairs at sides----- 4  
 Prosternum bearing one or more bristles on either side; abdomen largely reddish (North America, widespread).  
 dellephilae Osten Sacken (p. 33)
4. Apical joint of fore tarsi ordinary----- 8  
 Apical joint of fore tarsi elongated or distinctly bulged on sides----- 5
5. Tibiae and femora black----- 6  
 Tibiae broadly red at middle, femora largely so; parafacial almost linear below; last joint of fore tarsi distinctly shorter than the combined length of two preceding ones (Brazil).  
 bicolor, new species (p. 46)
6. Abdomen with well-defined pollinose cross bands, segments 2 and 3 shining on broad apices----- 7  
 Pollen on abdomen not in defined cross bands, the intermediate segments at least subpollinose to the hind margins; last joint of front tarsi hardly longer than normal; the black thoracic stripes separated and distinct on entire length (Georgia, Cuba)----- okefenokeensis Smith (p. 52)
7. Apical joint of fore tarsi greatly elongated approximating or exceeding the combined length of two preceding joints; third antennal joint black; abdomen gray pollinose (Mexico, Central and South America)----- pinguis Frbricius (p. 40)  
 Apical joint of fore tarsi much shorter than two preceding joints; antennae entirely reddish; pollen on abdomen tinged with yellow (Mexico, Central and South America).  
 xanthocera Wiedemann (p. 44)

8. Apex of scutellum red..... 9  
 Scutellum and abdomen wholly black, the latter highly polished  
 except on narrow bases of segments 2 and 3 (Ohio).  
*polita*, new species (p. 21)
9. Abdominal hairs long and erect..... 10  
 Abdominal hairs depressed or if partially erect distinctly less  
 than one-half the length of marginal macrochaetae..... 11
10. Tibiae pale yellow; third antennal joint black, fully three times  
 as long as second (? Massachusetts)..... *tibialis*, new species (p. 11)  
 Tibiae blackish; third antennal joint reddish, one and one-third  
 times the length of second (North America)..... *fumiferanae* Tothill (p. 12)
11. Parafrontals golden..... 12  
 Parafrontals cinereous or pale grayish yellow..... 15
12. Hind tibiae evenly ciliated at most with one or two longer  
 bristles..... 13  
 Hind tibiae with a row of wide-spaced uneven bristles on outer  
 posterior edge; abdomen slender, segments 2 and 3 pruinose  
 on basal third and shining black on broad apices (Maine).  
*vesiculata* Townsend (p. 20)
13. Abdomen gray pollinose..... 14  
 Last three abdominal segments golden pollinose on narrow base  
 of each, this color fading to pale yellow and gray apically;  
 antennae black, third joint fully three times the width of  
 parafacial below (British Columbia)..... *occidentis*, new species (p. 22)
14. Antennae red; palpi thickened apically; parafacials moderately  
 haired; mid tibiae usually with one large and one or more  
 smaller bristles near middle on outer front side; length 10 to  
 12 mm. (New England to Mexico)..... *datanae* Townsend (p. 29)  
 Third antennal joint blackish; palpi slender to tip; parafacials  
 inconspicuously haired; mid tibiae with a single stout bristle  
 on outer front side near middle; length about 8 mm. (Mary-  
 land, Indiana)..... *sinuata*, new species (p. 25)
15. Sides of abdomen obviously reddish..... 16  
 Sides of abdomen black, posterior half of intermediate seg-  
 ments shining black; third antennal joint three to four times  
 as long as second; the black thoracic stripes broad and very  
 distinct; length about 12 mm. (Canal Zone)..... *tricolor* van der Wulp (p. 42)
16. Arista of ordinary length thickened on proximal fourth or more..... 17  
 Arista slender to base and uncommonly long; third antennal  
 joint broad to apex, fully twice as long as the second; para-  
 facials bearing only a few inconspicuous hairs; hind tibiae  
 sparsely ciliate with one stouter near middle (Texas).  
*intermedia*, new species (p. 41)
17. Cheek in profile at least one-eighth the eye height; first abdomi-  
 nal segment usually with a pair of median marginal bristles;  
 mid tibiae with two or more bristles on outer front side near  
 middle; parafacials moderately to densely haired (Europe,  
 New England)..... *quadripustulata* Fabricius (p. 14)  
 Cheek in profile almost linear; first abdominal segment without  
 median marginals; mid tibiae with a single stout bristle near  
 middle on outer front side; parafacials usually very incon-  
 spicuously haired (North America, widespread)..... *rufopicta* Bigot (p. 31)

(1) *WINTHEMIA ANTENNALIS* Coquillett

*Winthemia antennalis* COQUILLETT, Proc. U. S. Nat. Mus., vol. 25, p. 115, 1902.—

TOTHILL, Can. Ent., vol. 44, pp. 1-2, 1912.

*Winthemia nigrifacies* BIGOT, Coquillett, Revis. Tachin., p. 125, 1897 (not Bigot).

Scutellum bearing only two lateral bristles; face and front plumbeous; abdominal hairs erect; ocellars weak or absent.

*Male*.—Front (before vertex) 0.286 of the head width in the one specimen; parafrontals subshining black faintly pruinose below, thickly clothed with long black hairs; median stripe brownish black, at antennae wider than one parafrontal but greatly narrowed toward triangle; inner verticals of moderate length, outer ones vestigial; no ocellars or orbitals; uppermost two frontals reclinate, stronger than the preceding ones but not very long, the lower bristles hardly on level with apex of second antennal joint; parafacial not much narrowed downward, thickly clothed with black hairs, which extend close to the eye border; facial ridges bare except a few hairs next to vibrissae, which are situated on oral margin; antennae black, third joint three times the length of second; arista also black, thickened on basal fourth, penultimate joint only slightly longer than wide; cheek in profile about one-seventh the eye height, destitute of pollen, black and clothed with short fine hairs; palpi slender, black at base brownish yellow on tips, beset with numerous black hairs; eyes densely pale-haired.

Thorax black, subshining, lightly dusted with pale-gray pollen; mesonotum with five narrow black stripes before suture and becoming indistinct behind; scutellum obscurely reddish at apex, in some angles apparently shining but pruinose in a flat rear view; calypters white, the rims tinged with yellow.

Abdomen black with a red color apparent on sides; segments 2 to 4 sprinkled with thin bluish-gray pollen, which extends nearly to the hind margins on segments 2 and 3; a median dark stripe and changeable blackish spots visible in most views on the intermediate segments; first segment without median marginals; second with a weak pair scarcely larger than the surrounding hairs; third bearing a marginal row of about 10 bristles; fourth with irregular placed discs and a marginal row of weaker bristles; venter without any defined patches of dense hairs on either third or fourth segments; inner genital forceps united and keeled behind, rather broad at base tapering to apex, which is shallowly notched; outer forceps nearly as long as inner ones, emarginate shortly before apex on the hind side, yellow.

Legs black; hind tibiae ciliate with one slightly longer bristle in the row; mid tibiae with one stout anterior bristle near the middle; claws and pulvilli elongate.

Wings hyaline; third vein with one hair at base; fourth vein with an oblique bend, beyond straight to costa; first posterior cell open well before wing tip.

*Female*.—Front 0.287 and 0.327 of the head width in two specimens, more densely pollinose than in male; the usual two pairs of orbitals present; uppermost three or four frontals reclinate; ocellars present but poorly developed; outer verticals about one-half as long as inner pair; palpi thickened apically; claws and pulvilli short.

Length, 6 to 8 mm.

*Type*.—Female, U.S.N.M. No. 6222, from Los Angeles County, Calif.

Redescribed from the following, all in the United States National Museum: 1 female, Dripping Springs, N. Mex. (T. D. A. Cockerell); 1 female (type), Los Angeles County, Calif., July (D. W. Coquillett); and 1 male, Summit, Mount Lowe, Calif., July 4, 1917 (J. M. Aldrich).

The species varies in the development of ocellar bristles. The type female has a weak or hairlike pair of ocellars; in the second female they are hardly distinguishable from the adjacent hairs, while the single male specimen shows none at all.

(2) *WINTHEMIA TIBIALIS*, new species

Abdomen densely gray pollinose, the hairs long and erect on dorsum of intermediate segments; tibiae yellow, the middle pair with two stout bristles on outer front side near middle; thoracic stripes indistinct.

*Male*.—Front (at vertex) 0.316 of the head width in the one specimen, widening rather slowly to base of antennae; parafrontals gray pollinose, covered with long black hairs; median stripe reddish brown, hardly narrowed upward, at antennae almost as wide as one parafrontal; verticals one pair (inner) developed; orbitals none; ocellars large, directed forward and outward; frontal rows strongly divergent beneath antennae, extending to base of third joint, the uppermost bristles not reduced in size, reclinate; sides of face gray pollinose, narrowed downward, bearing a few rather inconspicuous hairs, which extend from the lower frontals to about the middle along the inner margins; antennae black, almost reaching oral margin, third joint nearly four times the length of second; arista of moderate length, thickened on basal third, penultimate joint short; vibrissae on oral margin, the ridges with a few bristles above; palpi yellow; cheeks gray pollinose, clothed with long fine black hairs, in profile about one-sixth the eye height.

Thorax black, gray pollinose, with a rather noticeable yellow spot above wing base, which extends backward to include the pos-

terior callus; scutellum pale yellow, bearing three lateral, one discal, and one larger than usual decussate apical pair of bristles, hairs on disk long and erect; calypters opaque, white.

Abdomen nearly as broad as long, black in ground color, the sides obscurely reddish; last three segments with thick gray pollen extending well to the hind margins; first segment without median marginals; second with two large pairs; third with a marginal row; fourth entirely covered with long bristly hairs; no defined patches of hairs on venter. The genitalia have been dissected from the single specimen and now are apparently lost.

Legs except tibiae black; hind tibiae bearing a row of uneven bristles on the posterior edge; claws and pulvilli elongate.

Wings hyaline; first posterior cell open considerably before wing tip; third vein with three or four hairs at base; costal spine not developed.

*Female*.—Front 0.351 of the head width (head somewhat shrunken in the one specimen); the usual orbitals present; verticals two pairs; claws and pulvilli short; in other details very similar to male.

Length, 10.5 mm.

*Type*.—Female, U.S.N.M. No. 43339.

Described from 2 specimens in the United States National Museum: 1 female labeled 3101 G, May 16, 1910; and 1 male, 3101 G, May 13, 1910, with an additional Townsend dissection label TD4764. Presumably, both specimens are from Massachusetts.

### (3) *WINTHEMIA FUMIFERANAE* Tothill

*Winthemia fumiferanae* TOTHILL, Can. Ent., vol. 44, pp. 2-3, 1912; Can. Ent., vol. 45, pp. 74-75, 1913.—WALTON, Proc. Ent. Soc. Washington, vol. 15, p. 25, 1925.—JOHNSON, List, p. 203, 1925.—ESSIG, Insects West. North Amer., p. 584, 1926.—ALDRICH, Bull. Brooklyn Ent. Soc., vol. 22, p. 24, 1927.—WEST, New York State List, p. 817, 1928.

*Nemosturmia pilosa* TOWNSEND, Ins. Insc. Menst., vol. 14, p. 35, 1926.

*Male*.—Front greatly narrowed above, widening rapidly from about the middle to base of antennae, at narrowest 0.127 of the head width (average of four: 0.15; 0.12; 0.11; 0.13); parafrontals gray pollinose blackish near vertex, clothed with fine black hairs; median stripe reddish brown, triangular, at antennae wider than one parafrontal; frontals about 14 in number, the uppermost moderately strong, reclinate, the preceding ones decussate to antennae, extending about to the middle of second antennal joint; orbitals none; outer verticals not strong, about one-half as long as the inner pair; ocellars long, proclinate; parafacials gray pollinose, hardly at all narrowed downward, thickly clothed with hairs to or below middle except near eyes; antennae red more or less infuscated, third joint about one and one-fourth times the length of second; arista red, thickened on proximal

third, slender and darker in color beyond, basal joints short; palpi yellow, bearing a few long hairs on lower edge; cheek in profile about one-sixth the eye height, thinly gray pollinose on red ground color and thickly covered with black hairs; beard white, rather bushy.

Thorax black, thinly gray pollinose; dorsum marked with five narrow black stripes, which are sometimes very indistinct behind the suture; scutellum red, lightly dusted with white pollen. Chaetotaxy: Acrostichal, 3, 3; dorsocentral, 3, 4; humeral, 5; posthumeral, 2; presutural, 2; intraalar, 3 (none near suture); supraalar, 3; postalar, 2 or 3; pteropleural, 1 (small); sternopleural, 2, 1; scutellum with 3 lateral, 1 discal, and 1 decussate apical pair, the latter about as large as the median lateral; calypters semitransparent, white.

Abdomen rather pointed at apex, black with the sides tinged with red, subshining; the gray pollen on last three segments interrupted by a narrow dark stripe expanding to a roundish spot on the second segment; hairs rather fine, long, and erect; first two segments each with a pair of long median marginals; third with a marginal row of 12 to 14, large; fourth entirely covered above with erect bristles becoming weaker toward the apex; venter without defined patches of hairs; inner genital forceps feebly keeled near base behind, hardly at all tapering outward, the apex suddenly narrowed to an acute curved beak; outer forceps yellow, slightly longer than the inner, tapering to apical fourth thence expanded with the tips broadly rounded, the outer sides thickly pilose; fifth sternite blackish, with a broad deep V-shaped incision, the lobes bearing a few long fine black hairs.

Legs black; mid tibiae with two or three stout bristles on outer front side; hind tibiae ciliate, usually with one, sometimes two, longer bristles in the row; claws and pulvilli elongate.

Wings grayish hyaline tinged with brown at base; fourth vein with a sudden oblique bend curving inward shortly beyond, thence straight, reaching costa well before wing tip; third vein with two to four hairs at base; costal spine minute.

*Female*.—Front at vertex 0.335 of the head width (average of four: 0.36; 0.34; 0.32; 0.32), widening gradually to base of antennae; median stripe broad to triangle; inner and outer verticals strong; orbitals two pairs; sides of face distinctly narrowed downward; antennae red, third joint more than twice the width of parafacial at narrowest part; abdomen broader than in male and usually with less red color on sides, the hairs are coarse, often bristlelike along the median line; hind tibiae with a row of uneven bristles on outer edge; claws and pulvilli minute.

Length, 6.5 to 12 mm.

*Type*.—In the Canadian National Collection, from Duncan, British Columbia.

Redescribed from 40 specimens of both sexes. In the United States National Museum: 2 cotypes (male and female) reared from *Tortrix fumiferanae*, July 11–15, 1911, Duncan, British Columbia. From the following localities 18 males and 16 females: Oregon (A. L. Lovett); British Columbia (H. G. Dyar); Idaho (J. M. Aldrich); South Dakota (J. M. Aldrich); North Carolina (C. V. Riley, Franklin Sherman); Virginia (W. L. McAtee); Maryland (W. R. Walton); and Maine (C. W. Johnson). In Professor Hine's collection: 1 female from Loudonville, Ohio, June 6, 1915 (J. S. Hine). In my collection: 2 males from Crawford County, Ark., April 4, 1927 (D. G. Hall); and 1 female from Sugar Grove, Ohio, June 10, 1914 (H. J. Reinhard).

The species is closely related to *amoena* of Europe and may even be the same, in which case the latter name will replace the one here used. I have not seen any specimens of *amoena*. Until the type is examined, it appears expedient to consider the two forms as distinct.

#### (4) *WINTHEMIA QUADRIPUSTULATA* Fabricius

*Musca quadripustulata* FABRICIUS, Ent. Syst., vol. 4, p. 324, 1794.

*Tachina quadripustulata* FABRICIUS, Systl., p. 309, 1805.

*Tachina variegata* MEIGEN, Syst. Besch., vol. 4, p. 205, 1824.

*Chaetolyga rufonotata* BIGOT, Annales, p. 257, 1888.—BRAUER and BERGENSTAMM, Sitzungsbr. Kais. Mus., vol. 106, p. 349, 1897.

*Winthemia quadripustulata* FABRICIUS, Coquillett, Revis. Tachin., p. 125, 1897, a complex of several species. The numerous references in recent literature are subject to verification.

*Winthemia illinoensis* ROBERTSON, Can. Ent., vol. 33, p. 286, 1891.

*Winthemia rufonotata* BIGOT, Aldrich, Catalogue, p. 474, 1905.

Coquillett first identified the species from North America by comparison with European specimens received from Zeller. The latter specimens are still preserved in the National Museum and are the true *quadripustulata*, according to later determinations of European material by Nielson and Villeneuve. It is impossible to decide whether Coquillett had the correct American form associated in making his original identification, but later in his Revision of 1897 he did include no less than four apparently distinct species. Since that time *quadripustulata* has been generally considered in this complex sense, and our literature is replete with references to confused species under this name.

I have examined one type specimen (male) of *illinoensis*, but have been unable to find any structural characters to separate it. The type has sparse, rather long, erect abdominal hairs. This combination of characters, according to the original description, applies to the male sex only. Since there are intergrading forms in the material examined, the species can not be considered as distinct.



*Male*.—Front before ocelli 0.2 of the head width (average of five: 0.19; 0.18; 0.2; 0.22; 0.21), rather protuberant below; parafrontals covered with cinereous pollen, becoming thinner and blackish before vertex, thickly black-haired; median stripe wine-red; a little narrowed upward and wider than one parafrontal at triangle; ocellars of moderate size, directed forward but not much outward; orbitals none; verticals two pairs, outer ones smaller and often hairlike; frontal bristles 10 to 14 in number, extending to level with apex of second antennal joint, directed inward, reduced in size above and stopping before or at ocellar triangle; antennae black, third joint usually reddish near base on inner side, about one and one-half times as long as second; arista blackish, somewhat longer than antennae, thickened almost to middle, penultimate joint as broad as long; face gray pollinose, the sides moderately to thickly haired, at narrowest part about equal to the width of third antennal joint; vibrissae situated above the front border of mouth; cheeks red in ground color gray pollinose, thickly clothed with longish black hairs, in profile about one-sixth the eye height; palpi yellow, frequently infuscated basally, beset with numerous black hairs; back of head densely pale-haired.

Thorax black, gray pollinose, marked with five opaque black stripes, often poorly defined, and the thinner median one sometimes obliterated in front of suture; scutellum red, covered with uniform thin gray pollen; calypters opaque, white.

Abdomen black in ground color, the sides more or less tinged with red, this color on intermediate segments somewhat obscured by thick gray pollen, which is interrupted at middle by a large roundish spot on second and a narrow dark stripe on third; fourth segment reddish-yellowish on apical half or more, the gray pollen on base with a constant opaque black median spot and two longitudinal reflecting stripes on either side, which change from light to dark as the angle changes; hairs erect or suberect, not very dense; first segment either with or without one pair of median marginal bristles; second rarely without any, usually with one pair and sometimes with a complete marginal row; third with a marginal row of 10 to 14, large; fourth bearing several irregular rows beyond middle with erect bristly hairs in front; venter with no defined patches of dense hairs; genital segments yellowish, small and retracted; inner forceps of moderate length, keeled behind on basal two-thirds, thence flattened and sloping to the incised apex; outer forceps yellow, tapering outward to rounded tips, clothed with fine pale hairs on outer side, about three-fourths as long as inner pair; fifth sternite deeply incised, the lobes yellow, bearing a few slender black hairs.

Legs black; mid tibiae usually with one stout and one or more smaller bristles (sometimes only one large) on outer front side near middle; hind tibiae thickly ciliate with or without one longer bristle in the row; claws and pulvilli elongate.

Wings grayish hyaline with a brown tinge at base; fourth vein with a sudden oblique bend curving inward beyond reaching costa well before wing tip; third vein with one or two hairs at base; costal spine minute.

*Female*.—Front 0.313 of the head width (average of three), gray pollinose with a perceptible yellowish tinge; face and cheeks cinereous; the usual two pairs of orbitals present; inner verticals strong, outer ones only slightly smaller, curving outward; wing shorter and broader apically than in male; third antennal joint wider than parafacial below; claws and pulvilli short.

Length, 7 to 10.5 mm.

Redescribed from 39 specimens including several (both sexes) from Europe determined by Dr. J. Villeneuve. Distribution: New Hampshire (C. H. T. Townsend, Mrs. A. T. Slosson); Indiana, North Dakota, Idaho, Oregon, Washington (J. M. Aldrich); Illinois (Charles Robertson, W. A. Nason); Wisconsin, no collector's label; New Mexico, 6,500 and 7,000 feet (C. H. T. Townsend).

(5) *WINTHEMIA IGNOBILIS* van der Wulp

*Exorista ignobilis* VAN DER WULP, Biologia Dipt., vol. 2, p. 71, 1890.

The type, a male specimen from Amula, Guerrero, Mexico, is in the British Museum. I have not seen it, but determine the species from notes taken on the type specimen by Dr. J. M. Aldrich in 1929. The female sex is unknown to me.

*Male*.—Front moderately broad, before ocelli 0.233 of the head width (average of three: 0.25; 0.22; 0.23), rather protuberant below; parafrontals with plumbeous pollen becoming thinner upward and almost shining black before vertex, thickly clothed with longish upright hairs; median stripe blackish, wider than one parafrontal at antennae; verticals two pairs, the outer about three-fourths as long as inner ones; orbitals none; ocellar bristles well developed; frontal bristles 12 to 14 in number, reduced in size above and stopping before triangle, the lowermost nearly on level with apex of second antennal joint; face plumbeous pollinose, the sides moderately broad and thickly hairy; antennae black, second joint three-fifths as long as third; arista black, longer than antennae, thickened on basal two-fifths, penultimate joint slightly longer than wide; vibrissae situated a little above the front edge of mouth; palpi wholly black or yellow apically, rather slender, beset with numerous black hairs; cheeks black and subshining but with thin pollen apparent in certain views,

thickly black-haired, in profile about one-eighth the eye height, beard white.

Thorax black, thinly gray pollinose, marked with five opaque black stripes, the median one very thin but continuing before the suture, outer ones broad and not interrupted at suture, and separated by pollen bands of about equal width; scutellum red beyond narrow base, almost destitute of any pollen; calypters semitransparent, white with the rims faintly yellow.

Abdomen black in ground color, the sides more or less reddish; intermediate segments covered with gray pollen interrupted by a large roundish black spot on second and an elongated smaller spot on third; fourth segment largely reddish, with the pollen on basal margin showing a changeable spot on either side of the constant dark median one; hairs on intermediate segments erect or suberect; first segment without median marginals; second with a well-developed pair; third bearing a marginal row of about 10; fourth with several irregular rows near the apex and erect hairs in front; venter without any defined patches of dense hairs; genitalia as in *duplicata*, but the inner forceps more deeply incised at the apex.

Legs black; mid tibiae with one large median bristle (two in one specimen) on outer front side near middle; hind tibiae ciliate with or without a longer bristle in the row near middle; claws and pulvilli elongate.

Wings hyaline, yellowish near base; no costal spine; third vein with one or two hairs at base.

Length, 8 to 9.5 mm.

Redescribed from 3 male specimens in the National Museum from South America, as follows: 1, Angol, Chile, December 27, 1926, no collector's label; 1, Perales, Chile, September 23 (A. Faz); and 1, Pisicultura, Bariloche, Argentina, October 30, 1926 (Shannon).

(6) WINTHEMIA DUPLICATA, new species

*Male*.—Front at vertex 0.236 of the head width (average of three: 0.25; 0.23; 0.23), prominent below, widening rapidly beyond middle to base of antennae; median stripe wine red, not much narrowed upward, at antennae about equal the width of one parafrontal; the latter densely pale grayish-yellow pollinose except at vertex and thickly clothed with black hairs outside of frontal rows; inner verticals moderately developed, outer ones weak or hairlike; orbitals absent; ocellar pair of good size, proclinate but not much divergent; frontal bristles about 12 in number directed inward, extending below middle of second antennal joint, the uppermost reduced to hairs well before the ocellar triangle; face gray pollinose the sides more silvery, rather broad, bearing longish black hairs on the inner margin;

vibrissae well above the front edge of mouth; palpi yellow, rather strongly bowed, beset with black hairs, which are longer on lower edge; antennae reddish, third joint more or less infuscated, about twice as long as second and distinctly narrower than one parafacial; arista hardly as long as antennae, reddish and thickened on proximal third, penultimate joint about as broad as long; cheeks red in ground color, bluish-white pollinose, thickly haired, in profile about one-seventh the eye height.

Thorax black, subshining, thinly dusted with white pollen, which has a distinct bluish sheen; mesonotum marked with narrow black stripes, which are indistinctly visible when viewed from behind; scutellum red except on narrow base, thinly covered with blue-white pollen; calypters opaque, white, the rims tinged with yellow.

Abdomen broadly red on sides with a wide black median stripe produced laterally on the hind margins of segments 2 and 3 and expanding on the first including all but the posterior half at sides; last three segments except the red apex of fourth covered with thin bluish-white pollen interrupted by a narrow median vitta and the usual dark reflecting spots on base of fourth; first two segments without median marginal bristles; third with a marginal row of 10 to 14; fourth with an apical row and covered with erect bristly hairs in front; hairs on intermediate segments depressed; venter without any defined patches of dense hairs; genital segments small, retracted; outer forceps yellow, more tapering and pointed than usual; inner ones with a shallow notch at the curved apex, sharply keeled behind on basal two-thirds and exceeding the outer pair by about one-fourth their length; fifth sternite broadly and deeply incised, yellow.

Legs slender, black, the tibiae obscurely yellow; front claws and pulvilli equal the combined length of last two tarsal joints; mid tibiae with one stout bristle on outer front side beyond middle; hind tibiae thickly ciliate.

Wings hyaline with a yellow tinge at base; venation ordinary; third vein with one or two hairs at base; costal spine none.

Length, 10 to 11 mm.

*Female*.—Unknown.

*Type*.—Male, U.S.N.M. No. 43340.

Described from 3 male specimens from Hell Canyon, N. Mex., Manzano National Forest, September 16–19, 1916, on foliage of *Quercus* sp. (C. H. T. Townsend).

The species resembles *ignobilis*, but in the latter form the pollen on the front and face is plumbeous; the region of the vertex black and subshining; hairs on intermediate abdominal segments more or less erect; median marginals on second segment; antennae wholly black, etc.

## (7) WINTHEMIA TEXANA, new species

*Male*.—Front before triangle 0.175 and 0.2 of the head width in the two specimens, not very prominent below; parafrontals blackish above becoming densely gray pollinose downward, moderately beset with short hairs outside of frontal bristles; median stripe brownish black, exceeding the parafrontal width on entire length; verticals (inner pair) present moderately developed; frontals about 12 in number, directed inward and extending almost to apex of second antennal joint, the uppermost bristles smaller situated before the triangle; antennae hardly three-fourths as long as face, black, apex of second joint and base of third tinged with red, second joint three-fifths the length of third; arista shorter than antennae, thickened on basal fourth and very slender beyond, penultimate joint short; face cinereous pollinose, the sides narrow, clothed with longish black hairs; vibrissae slightly above the front edge of mouth; palpi yellow infuscated basally, slender, bearing numerous black hairs; cheeks gray pollinose, covered with fine hairs, in profile about one-seventh the eye height; back of head thickly pale pilose.

Thorax black, gray pollinose; mesonotum subshining showing five poorly defined black stripes when viewed from behind; scutellum red except on narrow basal margin, covered with uniform thin gray pollen; calypters opaque, white.

Abdomen broadly red on sides, this color beginning at middle of first segment and extending without interruption to the apex of the fourth, only a broad median dorsal and ventral stripe expanding on first segment black in ground color; last three segments with pale-yellow or grayish pollen, which on the intermediate segments is dense near base becoming thinner behind but extending almost to the posterior margin of each; fourth with the pollen confined to the basal half; a narrow dark median stripe present enlarged and forming a roundish spot on second segment; hairs except on anal segment depressed; no median marginal bristles on two basal segments; third with a marginal row of about 10; fourth with a marginal row and irregular placed bristles in front; venter sparsely and uniformly haired; inner genital forceps a little longer than usual, tapering uniformly from base outward to the moderately incised apex; outer forceps shorter than inner ones, not at all tapering outward, the tips broad or subtruncate, bearing numerous long black outwardly directed hairs on the sides; fifth sternite broadly and deeply incised, the inner margins of lobes blackish beset with long slender hairs.

Legs black; mid tibiae with two median anterior bristles; hind tibiae thickly and evenly ciliate; claws and pulvilli elongate.

Wings gray hyaline; venation as usual; third vein with one or two hairs at base; costal spine minute.

Length, 8.5 mm.

*Female*.—Unknown.

*Type*.—Male, U.S.N.M. No. 43580.

Described from two specimens taken at Menard, Tex., April and September, 1930, by H. E. Parish.

(8) *WINTHEMIA VESICULATA* Townsend

*Trisisyropa vesiculata* TOWNSEND, INS. INSC. MENST., vol. 4, p. 28, 1916.

*Winthemia vesiculata* TOWNSEND, JOHNSON, LIST, p. 203, 1925.

A rather slender shining black form, with the sides of the front densely yellow pollinose; apex of scutellum and abdomen reddish; abdominal segments 2 and 3 with whitish pollen on basal third to half, the hind margins shining black.

Front of female (vertex) 0.3 of the head width in the single specimen; face silvery pollinose, the sides with only a few hairs at middle none along border of eye; vibrissae on oral margin; antennae black, third joint reddish on inner posterior edge, broader than one parafacial and twice the length of second joint; palpi yellow; ocellars strong; orbitals two pairs, proclinate; verticals moderately developed; cheek in profile one-eighth the eye height.

Thorax narrower than usual; mesonotum shining black, lightly dusted with pale gray pollen, the dorsal stripes indistinct; scutellum sprinkled with grayish or white pollen becoming thinner toward base; calypters white tinged with yellow.

Abdomen slender, black, the sides and apex reddish; intermediate segments polished on about apical half but apparently subpollinose in a flat rear view; venter black, the narrow hind margin of the tergites pale yellow; first segment without median marginals; second with one large pair; third bearing a marginal row of about 10; fourth with a discal and a marginal row; hairs on segments 2 and 3 depressed.

Legs black; mid tibiae with one large and two small bristles near middle on outer front side; hind tibiae with a row of uneven bristles on the outer posterior edge; tarsal joints ordinary; claws and pulvilli short.

Wings hyaline; venation as usual; third vein with two hairs at base; costal spine minute.

Length, 9 mm.

*Male*.—Unknown.

*Type*.—Female, U.S.N.M. No. 19600.

Redescribed from the type specimen collected September 6, 1914, Sebago Lake, Me., by Dr. C. H. T. Townsend.

## (9) WINTHEMIA POLITA, new species

Abdomen largely polished, the basal fifth of segments 2 and 3 bearing thin bluish-white pollen; closely related to *W. vesiculata*, but the scutellum and abdomen are entirely black.

*Female*.—Front 0.25 and 0.26 of the head width in the two specimens; parafrontals shining black before vertex, thinly pollinose downward, sparsely haired; median stripe reddish-brown, much wider than one parafrontal before triangle; inner and outer verticals developed but not very long; orbitals two pairs, proclinate; ocellars present; lowermost frontals below middle of second antennal joint, upper two bristles in each row reclinate; sides of face silvery, sparsely haired along inner margins to middle or a little below; vibrissae situated on oral margin; antennae black, third joint hardly twice the length of second; arista black, longer than antennae, thickened on proximal fourth and slender beyond, penultimate joint short; cheeks very narrow in profile about one-twelfth the eye height, thinly gray pollinose on red ground color; palpi yellow; back of head with scanty pale hairs.

Thorax shining black, sprinkled lightly with whitish pollen, humeri and pleura more densely pollinose; four narrow dark stripes faintly visible in front and entirely disappearing behind suture; scutellum black, lightly dusted with white pollen; calypters with the hind lobe brown on inner third, white outwardly and the margin faintly yellow, opaque; the front lobes wholly white, semitransparent.

Abdomen black; the hairs depressed; first segment without median marginals; second with one pair; third with a marginal row of about 8; fourth covered with erect bristly hairs and bearing a row of stronger bristles well before the apex; ovipositor tubular in form, thick and fleshy.

Legs black, knees reddish; hind tibiae subciliate with one longer bristle near the middle; middle tibiae with one large median anterior bristle; tarsi ordinary; claws and pulvilli minute.

Wings subhyaline with a brownish tinge near base and along costal margin; fourth vein with a rectangular bend, beyond evenly concave to costa; first posterior cell open well before wing tip; third vein with two hairs at base; no costal spine.

Length, 6.5 to 8 mm.

*Male*.—Unknown.

*Type*.—Female, U.S.N.M. No. 43341.

Described from 2 specimens: 1 in the United States National Museum labeled "1950 August 15, TD 356," no locality but supposed to be from Massachusetts; the other in my collection taken at Brownhelm, Ohio, August, 1920 (H. J. Reinhard).

(10) *WINTHEMIA OCCIDENTIS*, new species

*Male*.—Front (before ocelli) 0.18 of the head width (average of five: 0.19; 0.18; 0.18; 0.17; 0.18), widening rapidly beyond middle to base of antennae; parafrontals covered with golden pollen fading out upward becoming blackish and subshining before vertex, moderately haired outside of frontal rows; median stripe brownish black, wider than one parafrontal on its entire length; verticals one pair (inner), not very large; orbitals none; ocellars of ordinary size, directed forward, not at all divergent; frontals about 12 in number, extending opposite to apex of second antennal joint, uppermost bristles small, decussate, situated well before apex of ocellar triangle; face gray pollinose, the sides concolorous below and golden from the lowermost frontals upward, sparsely clothed with rather coarse black hairs except along the margins of the eyes; antennae black, third joint tinged with red near base on inner sides, less than twice the length of second, slender but distinctly wider than parafacial at narrowest; arista thickened and reddish on proximal third, black in color beyond, penultimate joint as broad as long; cheeks blackish and thinly gray pollinose, thickly beset with fine black hairs, in profile about one-eighth the eye height; palpi black or often the tips yellow, slender; back of head with a dense ruff of grayish-white hairs faintly tinged with yellow above.

Thorax black, lightly dusted with gray pollen, mesonotum shining except in a flat rear view, the stripes largely obliterated; scutellum reddish beyond basal third, faintly pruinose, bearing three lateral, one discal, and a good-sized decussate apical pair of bristles; calypters opaque, golden becoming paler toward middle.

Abdomen black, with the sides and narrow apex conspicuously reddish; last three segments broadly covered with pollen, which on the narrow base of each is almost golden, becoming paler or grayish apically; intermediate segments shining on posterior half at the sides and on the narrow apices above; fourth shining on apical third, the pollen on basal margin interrupted by a black changeable stripe on either side of a constant median one, which extends forward narrowly on the third segment thence expanding and broadly interrupting the pollen from apex to base on second segment; basal segment without median marginal bristles; second with or without one pair; third with a marginal row of about 10; fourth with several irregular rows on apical half; hairs on intermediate segments depressed; venter without any defined patches of dense hairs; genital segments reddish yellow, small and retracted.

Legs black; mid tibiae with one bristle near middle on outer front side; hind tibiae evenly ciliate; claws and pulvilli elongate.



Wings grayish hyaline tinged with brown near base; fourth vein with a rounded rectangular bend strongly curved inward beyond reaching costa about one-half the length of hind cross vein before exact wing tip; third vein with one or two hairs at base; costal spine minute.

*Female*.—Front at vertex 0.3 and 0.272 of the head width in two specimens; parafrontals golden pollinose to vertex; inner and outer verticals developed, the usual orbitals present; palpi thickened and yellow on apical half; cheeks and face densely pale-gray pollinose; parafacials distinctly narrowed downward, inconspicuously short-haired; thorax covered with thick gray pollen tinged with yellow on mesonotum, which is marked with four distinct narrow shining black stripes; last three abdominal segments pollinose on about basal half, the remainder shining, second segment bearing a pair of stout median marginal bristles, fourth with a marginal and a discal row slightly beyond the middle; hind tibiae ciliate with one longer bristle in the row near middle, claws and pulvilli short; otherwise as in male.

Length, 7.5 mm.

*Type*.—Male, in the American Museum of Natural History.

Described from 7 males and 2 females received from C. H. Curran, collected at Wigwam Inn, Burrard Inlet, British Columbia, June 3 to 10, 1930 (G. R. Hopping), reared from "Western Hemlock Looper."

The species is related to *W. abdominalis* from which it differs in having thinner and paler pollen on the last three abdominal segments and the hind margin of each more broadly shining; the intermediate segments conspicuously reddish at sides; less robust in build.

(11) WINTHEMIA ABDOMINALIS Townsend

*Neowinthemia abdominalis* TOWNSEND, Proc. U. S. Nat. Mus., vol. 56, p. 583, 1919.

Last three abdominal segments almost wholly covered with striking thick pale-golden pollen, which instantly distinguishes the species in the male sex. The female is unknown.

*Male*.—Front at narrowest part 0.17 to 0.21 of the head width (in three specimens), hardly widening to about the middle thence rapidly to base of antennae; parafrontals yellow pollinose becoming velvety black toward vertex, rather densely pilose; median stripe brownish black, before ocelli distinctly wider than one parafrontal; inner verticals moderately strong; ocellars present; orbitals none; frontal rows strongly divergent below antennae extending to level with apex of the second joint, the upper bristles reduced in size and stopping before the triangle; parafacials not much narrowed down-

ward, gray pollinose tinged with yellow on upper portion, clothed with black hairs except next to eyes (in the type the hairs are arranged in three almost regular rows); vibrissae somewhat approximated, rather short, on oral margin; antennae black, base of third and apex of second joints reddish; third joint rather slender, less than twice the length of second; arista black, slightly thickened near base and very slender beyond middle; cheeks about one-sixth the eye height, densely haired; palpi blackish at base becoming brownish or yellow toward the tips and beset with numerous black hairs.

Thorax black, humeri and pleura conspicuously pollinose, mesonotum shining but with thin brownish pollen apparent in a flat rear view, the dark stripes very indistinct even before the suture; scutellum reddish, lightly dusted with pale pollen, bearing the usual three lateral and one decussate apical pair of bristles besides a discal pair; calypters tawny.

Abdomen black with a red color apparent on sides; the pollen on last three segments interrupted by a narrow but distinct black median stripe, which expands to a roundish spot on basal half of the second segment above; first and second segments without median marginal bristles, third with a marginal row of about 10; fourth covered with smaller bristles which are irregularly placed; hairs on intermediate segments depressed; venter without defined patches of thick or matted hairs.

Legs black; mid tibiae with one bristle on the outer front side near middle; hind tibiae densely and evenly ciliated; claws and pulvilli distinctly elongated.

Wings hyaline; venation as usual; third vein with one or two hairs at base; costal spine minute.

Length, 11 to 12 mm.

*Type*.—Male, U.S.N.M. No. 22254, from Dixie Landing, Va.

Redescribed from 4 males, including the type: 1 from Dixie Landing, Va., July 21, 1914, on foliage (C. H. T. Townsend); 1, Rockville, Pa., July 11, 1915 (E. Daecke), collection J. M. Aldrich; 1 labeled 231 (W. R. Walton collection). In Professor Hine's collection there is one specimen from Hinckley, Medina County, Ohio, August 8, 1903 (J. S. Hine).

The species is barely distinct from the European *W. speciosa* Egger, which differs in having the parafacials a little more densely haired; the third antennal joint slightly broader and almost three times as long as the second. Having seen only one specimen of the latter species, I can not determine the extent of variation that may occur, and I consider it expedient to recognize the two forms as distinct for the present.

## (12) WINTHEMIA SINUATA, new species

Sides of front yellow to golden pollinose, parafacials concolorous above often paler or wholly whitish, bearing only a few short hairs; mesonotum marked with five complete stripes; inner orbits sinuate in male.

*Male*.—Front moderately broad at vertex, slightly narrowed before triangle, thence widening rapidly to base of antennae, at narrowest part 0.242 of the head width (average of five: 0.24; 0.24; 0.23; 0.26; 0.24); median stripe reddish brown, occupying about one-third of the frontal width at triangle; verticals two pairs, rather small; ocellar bristles present; orbitals none; frontal bristles about 12 in number directed inward and extending to apex of second antennal joint, the uppermost hairlike and situated before apex of triangle; antennae three-fourths the length of face, black, the apex of second and base of third joint red, the latter less than twice as long as second joint; arista reddish, slightly thickened on basal two-fifths, penultimate joint short; vibrissae somewhat approximated, on level with oral margin; palpi yellow, beset with numerous black hairs; cheeks gray pollinose, clothed with fine short black hairs, about one-eighth the eye height.

Thorax black, gray pollinose; mesonotum with thinner pollen and marked with five shining black vittae; scutellum red beyond narrow base and covered with thin bluish-white pollen; postscutellum thinly pollinose; calypters opaque, white, the margins tinged with yellow.

Abdomen broadly red beginning with the first segment and extending continuously to apex of fourth, only a broad stripe in the middle black in ground color; intermediate segments gray pollinose nearly to hind margins; the pollen on fourth segment confined to basal half and interrupted by roundish spots which change from light to dark as the angle varies; first segment usually without median marginals; second with or without one pair; third bearing a marginal row of 10 to 12; fourth with several irregular rows near apex and erect bristly hairs in front; venter of third and fourth segments without any defined patches of matted hairs; inner genital forceps blackish, sharply keeled behind to apical third thence flattened and sloping forward to the divided apex; outer forceps yellow, triangular with the tips blunt or broadly rounded, clothed on outer side with numerous pale hairs; fifth sternite yellow, broadly and deeply incised.

Legs blackish; mid tibiae with one large anterior bristle near middle; hind tibiae ciliate with or without a longer bristle near middle; claws and pulvilli exceeding the length of last tarsal joint.

Wings subhyaline, with a faint yellow tinge near base and along costa; venation normal; third vein with one hair at base; costal spine vestigial.

*Female*.—Front at vertex 0.304 of the head width (average of five: 0.33; 0.29; 0.32; 0.3; 0.28), widening only slightly to base of antennae; parafrontals somewhat paler than in male, the yellow not extending below lowermost frontals; two pairs of proclinate orbitals present; face wholly white or silvery, the sides narrower than third antennal joint; hind tibiae sparsely ciliate with one longer bristle near middle; claws and pulvilli short.

Length, 7 to 9 mm.

*Type*.—U.S.N.M. No. 43342, from Plummers Island, Md.

Described from 42 male and 8 female specimens. In the United States National Museum: 1 male, Lick Brook, Ithaca, N. Y., August 12, 1928 (H. A. Scullen); 3 males, Sebago Lake, Me., September 6, 7, and 9, 1914 (C. H. T. Townsend); 1 male, Orono, Me., August 17, 1928 (O. A. Johannsen), "ex *Cingilia latenaria* Dru."; 1 male, Lake Metigoshe, Turtle Mountains, N. Dak., June 20, 1918 (J. M. Aldrich); 1 male, Mandan, N. Dak., June 16, 1918 (J. M. Aldrich); 1 male, Brookings, S. Dak., June 16, 1891 (J. M. Aldrich); 1 male, Big Stone City, S. Dak., June 8, 1918 (J. M. Aldrich); 3 males and 1 female, Lafayette, Ind., September 15, 1917, and July 16, 1915, a pair in copula (J. M. Aldrich); 2 males, Lawrence, Kans., without date (J. M. Aldrich); 1 male, Great Falls, Va., July 27, 1920 (C. T. Greene); 1 male, Chain Bridge, Va., July 1, 1923 (J. M. Aldrich); 1 male, Rosslyn, Va., June 25, 1913 (R. C. Shannon); 1 male, Inglebrook, Pa., May 28, 1911 (W. S. Fisher); 1 male and 1 female in copula, Beltsville, Md., September 2, 1917 (McDermott and Barber); 3 males, Plummers Island, Md., May 7 and July 11, 1909 (W. L. McAtee); and 1 male, Rock Creek, D. C., June 17, 1916 (G. E. Quinter). In the American Museum of Natural History: 3 males and 1 female, Tuxedo, N. Y., July 1, 23, and August 2, 1928 (C. H. Curran); 6 males and 2 females, Avon Old Farms, Avon, Conn., June 6 to 19, 1929 (C. H. Curran); 1 male, Salt Meadows, Newark, N. J., August (A. J. Weidt); 1 male, Atherton, Mo., June, without collector's label; 1 female, Saugus, Mass., September 5, 1914 (H. M. Parshley); and 1 male, labeled No. 379b, without locality. In the Illinois State Natural History Survey collection: 1 male, Antioch, Ill., August 1, 1924 (T. H. Frison); 1 male, Urbana, Ill., August 12, 1901 (E. G. Titus); and 1 female, without locality. In my collection: 3 males and 1 female, Brownhelm, Ohio, August 19, 1920 (H. J. Reinhard); 1 male, Sunfield, Mich., June 17, 1922 (L. G. Gentner); and 1 male, Ames, Iowa, July 19, 1929, "ex *Luperina stipata*" (G. C.

Decker). The last has been reported as *W. quadripustulata*, according to my determination, by Mr. Decker in Iowa Experiment Station Research Bulletin No. 125.

(13) WINTHEMIA BOREALIS, new species

*Male*.—Front at vertex 0.25 of the head width in the one specimen, rather prominent below; parafrontals golden pollinose to vertex, sparsely clothed with rather short black hairs below, which become longer and denser before vertex; median stripe brownish black, much narrower than one parafrontal on its entire length; verticals two pairs, the outer ones about the size of postocellars; no orbitals; ocellars broken off but the scars indicating bristles of the usual size; frontals about 14 in number, directed inward and extending to level with apex of second antennal joint, uppermost bristles small, situated about opposite the apex of triangle; face strongly receding, gray pollinose, the sides golden on upper three-fourths, rather thickly beset with longish black hairs; vibrissae on level with front edge of mouth; cheeks gray pollinose, black-haired, in profile about one-seventh the eye height; palpi yellow; antennae blackish, three-fourths the length of face, third joint less than twice as long as second; arista slightly thickened on proximal third, reddish, penultimate joint hardly longer than wide; beard grayish white, rather bushy.

Thorax black, thickly gray pollinose including the mesonotum, which is marked with five widely separated black stripes; scutellum reddish on apical half or more, gray pollinose, disk covered with rather long fine erect hairs; calypters opaque, white.

Abdomen with anal segment wholly bright orange-yellow, this color extending forward on the venter to middle of third segment, the remainder and the basal segments almost entirely black but faintly tinged with red on the sides; segments 2 and 3 largely covered with changeable bluish-gray pollen, which is rather dense on the narrow basal margin, becoming thinner behind but extending almost to the hind border of each; fourth segment shining, with gray pollen on basal fourth interrupted by reflecting spots, which change from light to dark as the angle varies; first segment with one pair of smallish median marginal bristles; second with two pairs and the third with a marginal row of about 14, all moderately stout; fourth with several irregular rows on apical half; hairs on intermediate segments rather coarse, long, and depressed; venter thickly long-haired but without any sharply defined patches; genital segments yellow, retracted; inner forceps tapering gradually from base to apex united and keeled behind as usual the tip moderately incised; outer forceps yellow, about three-fourths the length of inner ones, narrowed outwardly, the tips blunt or broadly rounded.

Legs rather stout, black, the knees reddish; mid tibiae with one large bristle near middle on outer front side; hind tibiae ciliate, the bristles not very closely placed, one near middle stouter and longer than the rest; claws and pulvilli as long as last two tarsal joints.

Wings grayish hyaline, slightly infuscated near base; venation as usual; third vein with one or two hairs near base; costal spine very minute.

Length, 10 mm.

*Female*.—Unknown.

*Type*.—In the American Museum of Natural History.

Described from one male received from C. H. Curran, collected at Transcona, Manitoba, Canada, June 24, 1924 (G. S. Brooks).

Although the genitalia are almost identical with those of *sinuata*, the species may be readily distinguished by the more prominent front and strongly receding face; the abdomen is darker on the sides and the fourth segment with a much narrower pollen band. There are other minor differences.

(14) *WINTHEMIA INTONSA*, new species

*Female*.—Front at vertex 0.3 of the head width (one specimen), rather prominent below, the sides thickly covered with dull pale-yellow pollen and bearing scattered fine short hairs; median stripe reddish, not much narrowed before triangle; verticals two pairs; ocellars and orbitals present; frontals descending to apex of second antennal joint, the uppermost two or three bristles in each row stout but not very long, reclinate; antennae reddish, third joint one and one-half times the length of the second; arista long, slender, with a short penultimate joint; sides of face dull pale yellow, thickly clothed with rather coarse black hairs, not much narrowed downward; vibrissae situated on lower edge of face; cheeks covered with dense grayish pollen, about one-eighth the eye height; palpi yellow; occiput thickly pale-haired.

Thorax black, gray pollinose, with four dark dorsal stripes and a median one apparent behind the suture in some views; scutellum reddish on apical half, gray pollinose, bearing only two lateral bristles besides a smaller decussate apical and a discal pair; calypsters opaque, white.

Abdomen black in ground color; the intermediate segments entirely covered with dense gray pollen; fourth segment wholly red, with reflecting changeable spots on the basal margin above; first segment without median marginals; second with one stout pair; third with a marginal row of about 12; fourth with irregular placed smaller discals and a marginal row; hairs on dorsum rather long and coarse but depressed.

Legs black; mid tibiae with one long bristle on front side near middle; hind tibiae with a row including two longer bristles on outer posterior edge; tarsi ordinary; claws and pulvilli shorter than last tarsal joint.

Wings hyaline; fourth vein curved inward beyond bend and reaching costa considerably before tip of wing; first posterior cell open; third vein with one hair at base; no costal spine.

Length, 9 mm.

*Male*.—Unknown.

*Type*.—Female, U.S.N.M. No. 43343.

Described from a single specimen collected at Kaslo, British Columbia, by R. P. Currie.

(15) *WINTHEMIA DATANAE* Townsend

*Exorista datanae* TOWNSEND, Trans. Amer. Ent. Soc., vol. 19, p. 288, 1892.

*Winthemia quadripustulata* (part) COQUILLETT, Revis. Tachin., p. 125, 1897.—

ALDRICH, Catalogue, p. 474, 1905.

Although the type series, consisting of three male specimens, is apparently lost, the species can be recognized with hardly any doubt from the original description. It is robust in build like *cecropiae* but may be readily distinguished in the male sex by the narrower front and the elongated claws and pulvilli.

Front in male 0.192 of the head width (average of five: 0.18; 0.19; 0.17; 0.22; 0.2), rather prominent below; median stripe reddish brown, narrowed behind and extending on either side of triangle to vertex; parafrontals pale yellow to golden pollinose more or less blackish and subshining before vertex, thickly clothed with black hairs; face grayish to yellow pollinose, the sides usually more distinctly yellow, conspicuously black-haired; vibrissae situated somewhat above the front edge of mouth; cheeks blackish, thinly gray pollinose and subshining in certain views, thickly covered with short black hairs the lower marginal row of bristles weak, in profile about one-seventh the eye height; palpi yellow rather strongly bowed, bearing longish black hairs on lower edge; antennae blackish, first two joints and third near base on inner side tinged with red, the latter joint hardly twice the length of second; arista reddish, thickened on about proximal third, penultimate joint slightly longer than broad; frontal bristles extending to apex of second antennal joint, the uppermost hairlike and situated well before the triangle; ocellars present; orbitals none; inner verticals moderately developed, outer ones vestigial; back of head thickly clothed with whitish hairs usually tinged with yellow above.

Thorax black, subshining, lightly dusted with gray pollen; mesonotum marked with five narrow black stripes often poorly defined, the

outer ones interrupted at suture and the median one sometimes obsolete in front; scutellum red except on narrow base; sprinkled with bluish-white pollen, usually bearing three lateral bristles but sometimes with four besides the apical pair; calypters opaque, white tinged with yellow.

Abdomen subshining, usually broadly reddish on sides and apex; intermediate segments with rather thin gray pollen extending nearly to hind margins, the pollen on basal half of fourth interrupted by four blackish longitudinal stripes, which change from light to dark as the angle varies; a narrow dark median stripe visible in most views; basal segments invariably without any median marginal bristles; third with a marginal row of about 10 stout; fourth bearing several irregular rows of smaller bristles near the apex and entirely covered with erect hairs in front; the hairs on intermediate segments fine, short, and depressed; venter without defined patches of dense hairs.

Legs black; front claws and pulvilli equal the length of last two tarsal joints; mid tibiae with one large and usually one or two smaller bristles on outer front side near middle; hind tibiae thickly ciliate.

Wings subhyaline, the anterior portion often brownish; venation as usual; third vein with one or two hairs at base; costal spine vestigial.

*Female*.—Front 0.294 of the head width (average of five: 0.29; 0.30; 0.32; 0.28; 0.28); parafrontals yellow pollinose to vertex and sparsely haired outside of frontal rows; median stripe occupying about one-third the frontal width; two pairs of verticals and orbitals present; third antennal joint broader, thorax more densely pollinose and the abdominal hairs coarser than in male; second segment of abdomen with a stout pair of median marginals; hind tibiae with one or more longer bristles in the row on outer posterior edge; claws and pulvilli short.

Length, 9 to 13 mm.

Redescribed from numerous specimens of both sexes from New England, Ohio, Michigan, and Illinois. Two males from Trinidad, West Indies, and 6 from Sanchez, Chihuahua, Mexico, are apparently the same. Two specimens of the original type series were reared from *Datana* sp.

The species, as may be noted in the description, is variable, but I have been unable to find any constant characters to separate additional forms. The United States National Museum contains a series reared from one parent host that varies with respect to the number of bristles on the front side of the middle tibiae; while other occasional specimens with three sternopleurals or four lateral scutellar-



bristles agree with the other details mentioned in the original description. The genitalia are quite alike in structure and show no tangible characters.

(16) *WINTHEMIA RUFOPICTA* Bigot

*Chaetolyga rufopicta* BIGOT, Annales, p. 259, 1888.—BRAUER and BERGENSTAMM, Sitzungsber. Kais. Mus., vol. 106, p. 349, 1897.

*Tricholyga fulvidapex* BIGOT, Annales, p. 265, 1888.

*Osactolyga fulvidapex* BIGOT, Brauer and Bergenstamm, Sitzungsber. Kais. Mus., vol. 106, pp. 24, 352, 1897.

*Mystacella tessellata* VAN DER WULP, Biologia Dipt., vol. 2, p. 56, 1890.

*Exorista ciliata* TOWNSEND, Trans. Amer. Ent. Soc., vol. 18, p. 363, 1891.

*Winthemia quadripustulata* (part) COQUILLETT, Revis. Tachin., p. 125, 1897.—ALDRICH, Catalogue, p. 474, 1905.

*Winthemia rufopicta* BIGOT, Aldrich, Catalogue, p. 474, 1905.

This is perhaps the commonest species of the genus in North America. Coquillett misidentified it and listed the form as a synonym of *quadripustulata* in his Revision. This was accepted by most subsequent authors, and our literature now contains many confused records that can not be accepted without verification.

One of the striking characters of the species is the greatly narrowed front in the male sex. In 100 specimens selected at random the front at the narrowest part by micrometer measurements ranged from 0.12 to 0.18 of the head width; only 3 specimens exceeded 0.17; and 86 specimens were within the limits of 0.13 to 0.16. The cheeks in both sexes are uncommonly narrow in profile view.

*Male*.—Parafrontals blackish and subshining near vertex, densely gray pollinose downward, clothed with short black hairs thicker on either side of triangle; median stripe brownish or black, narrowed behind but wider than one parafrontal at triangle; inner verticals rather short, outer ones vestigial; orbitals none; frontals 10 to 12, directed inward and extending below middle of second antennal joint, uppermost bristles weak, situated considerably before triangle; the latter densely haired with a pair of short proclinate hardly divergent bristles; face and cheeks gray pollinose on red ground color; parafacial narrow, sparsely to moderately clothed with slender black hairs; antennae about two-thirds the length of face, black, third joint red near base on inner side, slender, one and one-half times as long as second; arista rather short, slightly thickened near base, penultimate joint usually as broad as long; vibrissae approximated and somewhat above the front edge of mouth; palpi yellow, black-haired to tips, cheek in profile almost linear, about one-fifteenth the eye height; beard white.

Thorax, black subshining, lightly dusted with gray pollen, marked with five narrow black stripes often indistinct; scutellum red except

on narrow base, covered with thin gray pollen; calypters opaque, white with a faint yellow tinge.

Abdomen broadly red on sides with a wide black median stripe expanding on first segment and including all but the posterior half at sides, anal segment often blackish near base but sometimes wholly reddish yellow; intermediate segments gray pollinose or subpollinose to the hind margins; fourth with denser gray pollen on basal half showing three elongated changeable spots as the angle varies, the median one extending forward interruptedly on segments 3 and 2; basal segments ordinarily without any median marginal bristles though sometimes a pair present on the second; third segment bearing a marginal row of 8 to 12 strong bristles; fourth covered with shorter ones on apical half; venter without defined patches of hairs; genital segments small and retracted; inner forceps united except at tip with a rather prominent sharp keel behind, in profile thick to middle thence sloping forward to the abruptly curved pointed and divided apex, bearing long black hairs directed upward and outward; outer forceps yellow, with numerous long brownish hairs on outer side, about three-fourths as long as inner ones, tips rounded or blunt; fifth sternite with a broad deep incision, the lobes bearing long black hairs along the inner margins.

Legs slender, black; mid tibiae with one large median anterior bristle; hind tibiae thickly ciliate rarely with one longer bristle in the row; claws and pulvilli elongate.

Wings grayish hyaline; fourth vein arcuate beyond bend reaching costa well before wing tip; no costal spine; third vein with one or two hairs at base.

*Female*.—Front at vertex 0.26 to 0.29 of the head width, not much wider at base of antennae; parafrontals gray pollinose to vertex, bearing only a few short scattered hairs; the usual orbitals present; inner and outer verticals developed; uppermost frontals stout, reclinate, but not very long; antennae red, third joint more or less infuscated, wider than parafacial at narrowest; the latter usually very inconspicuously haired; thorax densely gray pollinose, the dorsal stripes distinct; second abdominal segment bearing a pair of median marginal bristles; claws and pulvilli short; hind tibiae less thickly ciliated than in male with one larger bristle near the middle.

Length, 5 to 11 mm.

*Type*.—In the collection of J. E. Collin, Newmarket, England.

Redescribed from more than 200 specimens (both sexes), March to October, College Station, Tex. (H. J. Reinhard). Distribution records: Mississippi (F. M. Hull); Iowa, reared from *Papaipema nebris*, July 26 and 27, 1929 (G. C. Decker); Michigan (L. G.

Gentner); Illinois (W. A. Nason, T. R. Frison); Ohio (H. J. Reinhard); Massachusetts (H. E. Smith); Virginia (J. M. Aldrich); and Maryland (R. C. Shannon).

The species is a common parasite of the army worm. *Militaris* has also been reported from this host, and may prove to be the same, but I have not been able to locate the type; the original description is too inadequate to identify the form with certainty.

(17) WINTHEMIA DEILEPHILAE Osten Sacken

*Tachina deilephilae* OSTEN SACKEN, Can. Ent., vol. 19, p. 164, 1887.

*Winthemia quadripustulata* (part) COQUILLET, Revis. Tachin., p. 125, 1897.—ALDRICH, Catalogue, p. 474, 1905.

This species, long submerged in synonymy, may be readily distinguished from all other known species by the presence of one or two slender bristles on each side of the prosternum. Sides of front and face grayish-white pollinose; abdomen red except a broad dark median stripe which expands in front and includes the basal margin of first segment; mid tibiae usually with two stout bristles on outer front side near middle.

*Male*.—Front (before ocelli) 0.237 of the head width (average of four: 0.25; 0.25; 0.23; 0.22), rather prominent below; parafrontals thickly covered with erect hairs near vertex, becoming thinner or scattered downward; median stripe red, at triangle fully twice the parafrontal width; verticals two pairs; orbitals none; ocellars well developed; frontal bristles about 10 in number directed inward, extending to middle of second antennal joint and stopping before triangle above, the uppermost one or two bristles smaller than the preceding ones; sides of face bearing a few inconspicuous hairs on inner margins, not unusually narrowed downward; vibrissae somewhat approximated about on oral margin but considerably above the lower edge of head; antennae red, third joint more or less infuscated, about twice as long as the second; arista rather short barely equaling the combined length of last two antennal joints, moderately thickened on proximal two-fifths; palpi yellow; cheeks gray pollinose on red ground color, in profile about one-ninth the eye height; beard white.

Thorax black, gray pollinose; mesonotum marked with five black stripes, the median one narrow but visible before suture in most views; scutellum red, rather densely gray pollinose; calypters opaque, white.

Abdomen largely red, covered with gray pollen devoid of any pattern, fourth segment with changeable spots on basal margin above; segments 1 and 2 without median marginal bristles; third with a marginal row of 8 to 10; fourth covered with erect

bristly hairs in front and bearing a row of stronger bristles before the apex; venter of third and fourth segments rather thickly pilose but the hairs not confined to patches with sharply limited margins; inner genital forceps united, keeled behind, hardly tapering to apical third thence rather sharply to apex which is bowed forward; outer forceps yellow, shorter, with broadly rounded tips.

Legs black; hind tibiae evenly ciliated; front claws and pulvilli equal the length of last two tarsal joints.

Wings hyaline; venation as usual; no costal spine; third vein with two or three hairs at base.

*Female*.—Front 0.35 of the head width (four measured); uppermost frontals moderately large, reclinate; orbitals two pairs; third antennal joint red, broader than in male; cheek about one-seventh the eye height; second abdominal segment with or without one pair of median marginal bristles; claws and pulvilli short.

*Type*.—Female, in the Museum of Comparative Zoology, Cambridge, Mass.

Redescribed from 20 specimens of both sexes. In the United States National Museum: 4 males and 3 females (including 1 female of the original type series reared from *Celerio* (*Deilephila*) *lineata* Fabr.), all labeled C. V. Riley collection, without date or locality; 1 female, from Ohio, June 25, 1901, no collector's label; 1 male, Onaga, Kans. (Crevecaeur); and 2 females, Bloomington, Ill., October, 1891 (C. C. Adams). In the Illinois State Natural History Survey: 1 male, Urbana, Ill., June 26, 1891 (Marten); and 1 female, Green Valley, Ill., September 2, 1899 (Hart). In the American Museum of Natural History: 2 females, Atherton, Mo. (C. F. Adams). In Professor Hine's collection: 1 female, from Hinckley, Medina County, Ohio, August 26, 1901 (J. S. Hine). In my collection: 3 males and 1 female, from College Station, Tex., June and July, 1918–1920 (H. J. Reinhard).

(18) *WINTHEMIA CECROPIAE*, new species

*Exorista leucaniae* var. *cecropiae* RILEY, Fourth Missouri Rep., p. 108, 1872; Gen. Index Missouri Reports, p. 60, 1881.

*Winthemia quadripustulata* (part) COQUILLETT, Revis. Tachin., p. 125, 1897.—ALDRICH, Catalogue, p. 474, 1905.

Riley never published a description of his proposed variety, but one male specimen of the original type series is still preserved in the United States National Museum. *E. leucaniae* is not recognizable from the description, and with no type specimen extant, so far as known, the name is dropped. Riley's name is here used, according to type, for a large or robust form that may be readily recognized by the abbreviated claws and pulvilli and the uncommonly broad front in the male sex. I am unable to associate the corresponding female in the material examined.

*Male*.—Front 0.283 of the head width in the one specimen, hardly widening to middle, thence gradually downward to base of antennae; parafrontals gray pollinose tinged with yellow, thickly clothed with black hairs; median stripe reddish, broad to triangle extending on either side to vertex; vertical bristles one pair (inner) developed; orbitals none; ocellars present; frontals directed inward, the uppermost very small and considerably before triangle, the rows strongly divergent below antennae and extending opposite to base of third joint; face gray pollinose, the sides narrow, faintly yellowish and bearing rather coarse black hairs near middle; vibrissae slightly above the mouth; cheeks gray pollinose on red ground color, thickly clothed with black hairs, in profile about one-seventh the eye height; palpi yellow; antennae fully two-thirds as long as face, black, second joint about three-fifths the length of third; arista rather short, reddish, slightly thickened near base, penultimate joint short; back of head pale-haired.

Thorax black, thinly cinereous pollinose; mesonotum with five poorly defined black stripes behind and four in front of suture; scutellum obscurely reddish, covered with uniform gray pollen; calypters opaque, white, the margins with a tawny tinge.

Abdomen black, the sides not very conspicuously red, but this color extending without interruption from the hind margin of first segment to the apex of fourth; last three segments almost wholly covered with thin gray pollen devoid of any definite pattern and interrupted by a narrow dark median stripe; the hairs fine and depressed, except on anal segment; basal segments without any median marginal bristles; third with a marginal row; fourth bearing erect bristly hairs near base with stronger bristles at the apex extending forward on the sides; venter of the fourth segment thickly haired almost with matted patches, but the margins poorly defined.

Legs black, the tibiae obscurely yellow; claws and pulvilli not exceeding the length of apical tarsal joint; mid tibiae bearing one large and two smaller bristles near middle on outer front side; hind tibiae evenly ciliate.

Wings hyaline, but with a yellow tinge at base and along costa; no costal spine; venation as usual; third vein with one hair at base.

Length, 11 mm.

*Type*.—Male, U.S.N.M. No. 43579.

Described from the proposed type specimen reared from *Platysamia cecropia* collected at Rockford, Ill., September, 1866. Another male probably belonging to the same species is in the Illinois State Natural History Survey collection, taken October 8, 1908, "from *cecropia*" (Sanders); it differs in having the front narrower at vertex and gradually diverging all the way to base of antennae.

(19) *WINTHEMIA LATEVITTATA* van der Wulp

*Exorista latevittata* VAN DER WULP, Biologia Dipt., vol. 2, p. 66, 1890.

The species is known only in the male sex. It resembles *pinguis* but may be readily separated by the characters mentioned in the key.

*Male*.—Front at narrowest (before vertex) 0.234 of the head width in the single specimen; parafrontals clothed with short hairs; thorax marked with four black stripes narrowly separated in front but fused behind suture effecting two broad bands; palpi blackish on basal half or more, tips yellowish; abdomen with uniform bluish-gray pollen, which extends almost to the hind edge of segments 2 and 3; fourth segment largely reddish; venter of third and fourth segments thickly haired but without any sharply defined patches. Wings and legs as in *pinguis*.

Length, 9 mm.

Redescribed from one male cotype in the United State National Museum from Xucumanatlan, Guerrero, Mexico, 7,000 feet, July (H. H. Smith).

(20) *WINTHEMIA MONTANA*, new species

## PLATE 1, FIGURE 1

A robust species with a supplementary outer row of frontal bristles on the widest part of the front; face tinged with yellow, the parafrontals densely gray pollinose to vertex; thorax conspicuously vittate.

*Male*.—Front 0.23 of the head width in the two specimens, slightly narrowed before vertex and thence widening rapidly to base of antennae; parafrontals densely pilose; median stripe reddish brown, exceeding the width of one parafrontal above; inner verticals moderately developed; outer ones about one-half as large; ocellars present, rather small; no orbitals; frontal bristles directed inward becoming smaller upward and stopping before triangle, the lowermost about on level with arista; parafacial with a few hairs near middle on inner margin, not much narrowed below; antennae black, apex of second joint and base of third reddish, third joint two and one-half times as long as second and about as wide as parafacial at narrowest; arista longer than antennae slightly thickened on proximal third, penultimate joint short; vibrissae on level with oral margin, the ridges above practically bare; palpi yellow, bearing numerous black hairs; cheeks blackish, thinly pruinose and densely haired, about one-seventh the eye height; beard white, rather bushy.

Thorax black, cinereous pollinose; mesonotum marked with four well-separated broad black stripes not interrupted at suture; scutellum beyond the narrow base red, thinly sprinkled with pale-grayish pollen; calypters white.

Abdomen black in ground color, the sides broadly reddish; last three segments gray pollinose, in a flat view the pollen extends to the hind margins of the intermediate segments; the pollen on base of fourth with reflecting spots which change from light to dark in opposite angles; first segment without median marginal bristles; second without any in one specimen and an unequally developed pair in the other; third bearing a marginal row; fourth segment covered with long bristly hairs becoming stronger toward the apex; hairs on intermediate segments depressed; genital segments yellow, small, and retracted; inner forceps blackish, longer than usual, narrow at base and tapering gradually to an acute undivided tip; outer forceps yellow, about as long as inner ones, also rather slender but not much tapering, the tips slightly bowed forward, with black bristly hairs on outer side; venter with large roundish sharply defined patches of glossy-black hairs on the third segment, none on fourth.

Legs black; hind tibiae thickly and evenly ciliate; mid tibiae with one stout anterior bristle near middle; claws and pulvilli elongate.

Wings subhyaline, brownish at base with a fainter tinge on anterior border; no costal spine; venation as usual; third vein with one hair at base.

Length, 12 mm.

*Female*.—Unknown.

*Type*.—Male, U.S.N.M. No. 43345.

Described from two specimens from Indian Creek Canyon, Chiricahua Mountains (6,100 feet), Ariz. (C. H. T. Townsend).

(21) WINTHEMIA MIMA, new species

PLATE 1, FIGURE 2

*Male*.—Front 0.21 to 0.24 of the head width (four measured), hardly widening to middle thence rapidly downward to antennae; median stripe brownish black, at triangle wider than one parafacial; front yellow pollinose, clothed with fine short hairs; ocellar bristles absent; verticals two pairs; orbitals none; frontal rows diverging below and extending about to the level of arista; sides of face with black hairs, which extend downward almost to the cheeks; antennae black, reaching lower fourth of face, third joint twice the length of second and slightly wider than parafacial at narrowest; arista black, slender, with a short penultimate joint; palpi black on proximal half yellow apically, beset with black hairs; cheeks gray pollinose, clothed with black hairs, in profile about one-eighth the eye height.

Thorax black, with the gray pollen thinner on mesonotum; the latter marked with four broad black uninterrupted stripes separated

by narrower pollinose bands; scutellum red beyond base, lightly dusted with gray pollen; calypters pale to golden yellow.

Abdomen black, the sides and apex reddish; last three segments with wide bands of yellowish-gray pollen, shining on hind margins; first two segments without median marginals; third with a marginal row; fourth with several irregular rows near the apex and entirely covered with bristly hairs in front; hairs depressed on intermediate segments; venter with sharply defined patches of densely matted hairs on third segment, none on fourth; inner genital forceps blackish, tapering rapidly at base and very slender beyond terminating in an acute tip; outer forceps yellow, usually bearing numerous long black hairs on the outer side, equal the length of inner pair, the width uniform from base outward to near apex which is broadly curved on posterior extremity with the anterior corner pointed and slightly produced.

Legs black; hind tibiae evenly ciliate; mid tibiae with one large bristle on outer front side near middle; claws and pulvilli elongate.

Wings subhyaline with a brownish tinge at base extending toward tip on costal border; venation normal; no costal spine; third vein with one or two hairs near base.

Length, 7 to 11 mm.

*Female*.—Unknown.

*Type*.—U.S.N.M. No. 43346.

Described from 20 specimens. Five in the United States National Museum as follows: 1, R. Charape, Peru (4,500 feet), September 14, 1911 (C. H. T. Townsend); 2, Taboga Island, Panama, February 14, 1912 (A. Busck); 1, Higuito, San Mateo, Costa Rica (Pablo Schild); 1, La Providencia, Obispo, Guatemala (C. M. Rouillard). In Professor Hine's collection: 1 from Panzos, Guatemala, March 18, 1905 (J. S. Hine). In the American Museum of Natural History: 8, Corozal, Canal Zone, January-February, 1929 (C. H. Curran); 2, Patilla Point, Canal Zone, January (C. H. Curran); 2, Chapada, Brazil (H. H. Smith); 2, Barro Colorado Island, Canal Zone, January, 1929 (C. H. Curran).

The species resembles *W. xanthocera*, but may be readily separated in the male sex by the absence of orbital bristles and the elongate claws and pulvilli. The female has not been identified in the material examined. I venture the opinion that it lacks ocellar bristles as in the male, but *xanthocera* often has them greatly reduced in size and sometimes also entirely wanting.

(22) *WINTHEMIA SINGULARIS*, new species

PLATE 1, FIGURE 3

*Male*.—Front at vertex 0.258 of the head width (one specimen), hardly widening for some distance below and thence rapidly to base



of antennae; parafrontals gray pollinose, with scattered short hairs and a few bristles outside of the frontal rows; uppermost frontal bristles reduced in size and stopping at triangle, the lower ones on level with base of third antennal joint; ocellars small or hairlike; orbitals none; outer verticals about half as long as inner ones; median stripe brownish black, a little narrowed behind but at triangle distinctly wider than one parafrontal; sides of face gray, bearing a few black hairs, none extending next to the eyes; antennae blackish, reaching lower fourth of face, third joint hardly twice the length of second and only slightly wider than the parafacial at narrowest part; arista black, long and slender, basal joints short but distinct; cheeks blackish, thinly covered with gray pollen, about one-seventh the eye height; palpi yellow, beset with numerous short black hairs.

Thorax black, gray pollinose; mesonotum marked with four broad distinct black stripes; scutellum broadly reddish, dusted with changeable pale-gray pollen, bearing the usual three lateral, one discal, and one small decussate apical pair of bristles; calypters tawny.

Abdomen black in ground color, the sides and apex reddish yellow; last three segments with gray pollen, which in dorsal view includes about the basal half of each, fourth segment with three reflecting or changeable spots on basal margin above; segments 1 and 2 without median marginals; third with a marginal row of about 8; fourth with a row of weak marginals and covered with bristly hairs in front; hairs on intermediate segments depressed; venter with a large sharply defined patch of long matted hairs on third segment which extends without interruption on the basal margin of the fourth; inner genital forceps blackish, narrow at base tapering uniformly to an acute undivided tip; outer forceps yellow, about as long as inner ones, perceptibly narrowed near middle with the anterior extremity broadly produced.

Legs black; mid tibiae with one stout bristle on outer front side near middle; hind tibiae evenly ciliate; claws and pulvilli elongate.

Wings faintly brownish along the costa and at base; venation normal; third vein with one hair at base; costal spine minute.

Length, 9.5 mm.

*Female*.—Unknown.

*Type*.—Male, U.S.N.M. No. 43347.

Described from 1 specimen from Tucuman, Argentina, March 21, 1918, "ex black woolly bear," with puparium on pin, no collector's label.

(23) *WINTHEMIA IMITATOR*, new species

*Male*.—Front 0.187 and 0.205 of the head width in the two specimens, slightly narrowed before triangle, widening rapidly downward

from middle to base of antennae; parafrontals gray pollinose to vertex, moderately haired and bearing a few bristles outside of the frontal rows below; verticals two pairs; ocellars present; orbitals none; frontal bristles extending opposite to apex of second antennal joint the uppermost erect or slightly reclinate (weak or hairlike in one specimen) and situated before triangle; antennae about three-fourths as long as face, black, third joint more or less tinged with red, slender, second joint almost two-thirds the length of the third; arista about as long as antennae, reddish, hardly thickened basally, with a short penultimate joint; face gray pollinose, the sides narrowed downward, bearing slender black hairs on the inner margins; vibrissae on level with front border of mouth; palpi reddish yellow, slender to tips, beset with black hairs; cheeks red in ground color, covered with gray pollen and dense black hairs, in profile about one-eighth the eye height; occiput densely gray pollinose, with a thick ruff of whitish hairs.

Thorax black, densely gray pollinose, marked with five black dorsal stripes, the median one narrower and obliterated in front of suture; scutellum red except the narrow basal margin, dusted with thin grayish-white pollen; calypters opaque, white the margins broadly yellow.

Abdomen red on sides and apex with a broad black median stripe widening in front and including most of the basal segment; intermediate segments covered with changeable pale-grayish pollen, which in some views extends to the hind margin of each; basal half or more of the fourth segment covered with thicker pollen, which is interrupted by a dark median stripe continuing on segments 3 and 2; hairs except on anal segment depressed; no median marginal bristles on segments 1 and 2; third bearing a marginal row of 10 to 12, large; fourth with a subdiscal and an apical row of smaller bristles; venter with defined patches of dense hairs on third and fourth tergites, small on latter; inner genital forceps of ordinary width, sharply keeled behind, tapering beyond middle to the slightly incised apex; outer forceps shorter than usual, about one-half the length of inner ones, triangular, yellow.

Legs moderately stout, black tinged with red; front claws and pulvilli about equal the length of last two tarsal joints; mid tibiae with one large bristle on outer front side near middle; hind tibiae thickly and evenly ciliate.

Wings grayish hyaline; veins reddish yellow; venation normal; no costal spine; third vein with one setule at base.

Length, 9.5 to 10.5 mm.

*Female*.—Unknown.

*Type*.—In the Illinois State Natural History Survey Museum, Urbana, Ill.

Described from two specimens received from Dr. T. H. Frison, collected at Brownsville, Tex., November 29 and December 1, 1910, no collector's label.

This species might be mistaken for *intermedia* without examining the genitalia, but may be distinguished by the longer second antennal joint, yellow calypters, stouter and shorter legs, and denser pollen on fourth abdominal segment.

(24) WINTHEMIA INTERMEDIA, new species

PLATE 1, FIGURE 4

Face and front gray pollinose; sides of abdomen broadly reddish; thoracic stripes widely separated and distinct; male often with a partial secondary row of frontals outside of the main rows below.

*Male*.—Front (before ocelli) 0.196 of the head width (average of five: 0.18; 0.19; 0.2; 0.18; 0.23); parafrontals clothed with fine black hairs; median stripe blackish, narrowed behind but distinctly wider than one parafrontal before triangle; ocellars present, the triangle thickly covered with erect black hairs; inner verticals moderately strong, outer ones about equal the postocellars in size; no orbitals; uppermost frontals reduced in size and stopping before triangle, the rows divergent below and extending to base of third antennal joint; sides of face silvery, moderately haired on inner margins; antennae black, base of third joint obscurely reddish, hardly twice the length of second; arista longer than antennae, slender to base, penultimate joint as broad as long; cheeks gray pollinose on red ground color, thickly covered with fine short black hairs, about one-seventh the eye height; palpi yellow more or less infuscated basally, beset with numerous black hairs to tip; beard wholly pale or whitish.

Thorax black, gray pollinose; mesonotum with four widely separated and very distinct black stripes in front and five behind the suture; scutellum red, sprinkled with whitish-gray pollen; calypters opaque, white.

Abdomen black, the sides and apex reddish; last three segments largely covered with changeable grayish-white pollen, which on base of fourth segment is interrupted by four reflecting spots that change from light to dark in opposite angles; a narrow median stripe apparent, widening to a roundish spot near base of second segment; first segment without median marginal bristles; second with or without one pair; third with a row of about 12, stout; fourth entirely covered with erect bristly hairs and bearing irregular rows of rather weak bristles near apex; hairs on intermediate segments depressed; venter

with defined patches of dense hairs on third and fourth segments, smaller on latter; genital segments yellow; inner forceps blackish, in posterior view narrower than usual, tapering from base to an acute apex, feebly keeled on basal half behind; outer forceps yellow, nearly equal the length of inner ones and also narrower than usual, tips truncate with the anterior corner bearing a minute hook; fifth sternite deeply incised, the lobes yellow bearing long black hairs on the inner margin.

Legs black, long, and slender; mid tibiae with one large bristle on outer front side near middle; hind tibiae evenly ciliate; front claws and pulvilli as long as last two tarsal joints, the hind ones somewhat shorter.

Wings tinged with yellow at base and on costal margin; venation as usual; third vein with one to three hairs at base; no costal spine.

*Female*.—Front at vertex 0.282 of the head width (average of five: 0.28; 0.29; 0.27; 0.29; 0.28); uppermost one or two frontals rather stout, reclinate; verticals and orbitals two pairs; third antennal joint moderately broad, about two and one-fourth times the length of second; palpi noticeably thickened apically; thorax with denser and paler pollen than in male; second abdominal segment bearing a stout pair of median marginals, the fourth with a subdiscal and a marginal row of strong bristles; hind tibiae ciliate with one or two longer bristles in the row near middle; claws and pulvilli short.

Length, 8 to 11 mm.

*Type*.—Male, U.S.N.M. No. 43348, from College Station, Tex.

Described from 39 specimens. In the United States National Museum 9 males as follows: 1, Melrose Highlands, Mass., September 13, 1914 (C. H. T. Townsend); 1, Cabin John, Md., July 26, 1916 (R. M. Fouts); 1, Campinas, Brazil, March, 1924 (F. X. Williams); 1, La Providencia, Obispo, Guatemala (J. M. Aldrich); 1, Higuito, San Mateo, Costa Rica (Pablo Schild); 1, Taboga Island, Panama (A. Busck); 3, Posorja, Ecuador (F. Campos), collection J. M. Aldrich. In the American Museum of Natural History: 9 males from Chapada, Brazil (H. H. Smith); 1 from Barro Colorado Island, Canal Zone (C. H. Curran). In my collection: 6 males and 14 females from College Station, Tex., April–October, 1919–1930 (H. J. Reinhard).

(25) *WINTHEMIA TRICOLOR* van der Wulp

PLATE 1, FIGURE 5

*Exorista tricolor* VAN DER WULF, Biologia Dipt., vol. 2, p. 67, pl. 3, fig. 9, 1890.

A robust species with the hind tibiae thickly and evenly ciliated; abdominal segments 2 and 3 shining on posterior half, the sides conspicuously reddish in male only, which has rather small but sharply defined patches of dense hairs on venter of third and fourth tergites; claws and pulvilli greatly elongated in male, not in female.

*Male*.—Front (vertex) 0.24 of the head width (average of four: 0.24; 0.24; 0.23; 0.25), not much wider at base of antennae; parafrontals rather densely short-haired, covered with gray pollen, which becomes thinner above showing a black color near the vertex; median stripe reddish brown, hardly at all narrowed behind, where it is deeply cleft by the triangle, which is thinly pollinose; verticals two pairs, rather short; no orbitals; ocellars distinct but not very large; frontal bristles directed inward stopping before triangle, the lowermost ones at or a little below base of second antennal joint; face gray pollinose, the sides bearing about a dozen slender hairs along the inner margins; vibrissae on oral margin with three or four coarse bristles on the ridges above; palpi yellow; antennae reddish, third joint darker, broad to tip and from three to four times the length of second; arista longer than antennae, thickened on proximal third, penultimate joint slightly longer than broad; cheeks red in ground color, gray pollinose, thickly clothed with short black hairs, about one-eighth the eye height; eye long and narrower than usual in lateral aspect, by micrometer the profile width 12 and the length 31 units; beard bushy, white.

Thorax cinereous pollinose, marked with four widely separated black stripes in front of suture and five behind; scutellum red, uniformly gray pollinose except at base, the decussate apical bristles larger than usual, hairs on disk short; calypters white tinged with yellow.

Abdomen without median marginals on segments 1 and 2; third with a marginal row of 10 to 12, large; fourth covered with erect bristly hairs at base becoming longer and stronger toward apex; in some lights the dark color of the intermediate segments extends forward on either side of the median line so that the pollen bands appear narrower above; pollinose band on base of fourth segment showing reflecting spots which change from light to dark as the angle changes, the apex red; genitalia larger than usual; outer forceps yellow, broad with blunt tips and bearing a few pale hairs on outer side; inner forceps blackish, a little longer than outer ones, in profile strongly bowed and rather thick to middle, feebly keeled on narrow base behind and hardly at all tapering to the divided apex.

Legs black; mid tibiae with one large bristle on the outer front side near middle.

Wings grayish hyaline; fourth vein with a sudden oblique bend, concave shortly beyond thence straight to costa ending well before wing tip; third vein with one or two hairs at base; costal spine minute.

*Female*.—Front at vertex 0.275 of the head width (average of four: 0.28; 0.27; 0.29; 0.26); thorax densely cinereous pollinose; uppermost two or three frontals reclinate, and the usual two pairs of

orbitals present; sides of abdomen black and the apex red, second segment bearing one pair of stout median marginal bristles; otherwise similar to male.

Length, 9.5 to 13 mm.

*Type*.—In the British Museum of Natural History.

Redescribed from 15 males and 10 females in the United States National Museum, all collected at Summit, Canal Zone (J. Zetek), and labeled "ex *Arsenura erythrinae* Fabr." One female from Higuito, San Mateo, Costa Rica (Pablo Schild), is apparently the same. In the American Museum of Natural History there are 24 specimens, including both sexes, from Chapada, Brazil (H. H. Smith). The males of this series have the outer genital forceps broader at the apex and somewhat longer but there appear to be no other tangible characters differing from the remainder of the material examined.

(26) *WINTHEMIA XANTHOCERA* Wiedemann

PLATE 1, FIGURE 6

*Tachina xanthocera* WIEDEMANN, AUSS. Zweifl., vol. 2, p. 329, 1830.

*Masipoda xanthocera* WIEDEMANN, Brauer and Bergenstamm, Denk. Wien.

Akad. Wiss., vol. 56, p. 163, 1889; vol. 58, p. 402, 1891; vol. 60, p. 123, 1893.

*Exorista ochracea* VAN DER WULP, Biologia Dipt., vol. 2, p. 63, 1890.

*Exorista rubicornis* VAN DER WULP, Biologia Dipt., vol. 2, p. 66, 1890.

*Exorista sororcula* VAN DER WULP, Biologia Dipt., vol. 2, p. 68, 1890.

*Winthemia xanthocera* WIEDEMANN, Aldrich, Proc. U. S. Nat. Mus., vol. 72, p. 14, 1927.

Orbital bristles present in both sexes, claws and pulvilli minute; ocellars often poorly developed and sometimes wanting; apical joint of fore tarsi in female somewhat swollen but not noticeably elongated.

*Male*.—Front broader than usual with the sides almost parallel, at vertex 0.306 of the head width (average of three: 0.29; 0.32; 0.31); median stripe reddish brown, broad to triangle and occupying one-third of the frontal width; parafrontals gray pollinose, very sparsely haired from vertex downward; frontal bristles about 8 in number, extending below the middle of second antennal joint, uppermost two or three bristles stout and reclinate; inner verticals strong, nearly erect, the outer ones about two-thirds as long; face silvery, the sides narrow, bearing only a few slender hairs on the inner margin; vibrissae situated on level with oral margin; palpi yellow, bearing numerous short black bristly hairs; antennae almost reaching oral margin, basal joints blackish, third largely red, about three times the length of second; arista distinctly longer than antennae, hardly at all thickened toward base, color red to middle and darker beyond, penultimate joint very short; cheeks red in ground color, gray pollinose and covered with moderately long black hairs, about one-seventh the eye height; posterior surface of head thickly pale-haired.

Thorax black, covered with dense gray pollen tinged with brown on mesonotum; the latter marked with five black stripes, the median one narrow and disappearing in front, the outer two pairs not interrupted at suture and separated on entire length by narrower pollen stripes; scutellum reddish at tip, thickly gray pollinose except on basal margin; calypters opaque, white, the rims faintly yellow.

Abdomen black in ground color, segments 2 and 3 covered on basal half or more with dense pale yellowish-gray pollen obscuring the red color on sides, anal segment red on apical half the remainder densely pollinose; the pollen bands on these segments interrupted by a narrow dark median stripe; no median marginal bristles on basal segment; second usually without but sometimes a pair present; third with a marginal row of about 10, stout; fourth bearing a marginal and a discal row with only sparse hairs in front and behind the latter; venter of third segment with defined patches of matted long black hairs, none on fourth; inner genital forceps of moderate length, rather broad at base, narrowed more rapidly beyond middle to the apex; outer forceps about two-thirds as long, with broad evenly rounded tips, yellow.

Legs black; hind tibiae ciliate with one slightly longer bristle in the row; mid tibiae with one large median anterior bristle; claws and pulvilli very short.

Wings distinctly brown to the third longitudinal vein, the color fading out entirely near the hind border except a tinge along the apical cross vein; first posterior cell open well before wing tip; no costal spine; third vein bearing one or two setules at base.

*Female*.—Front hardly as wide as in male, at the vertex 0.29 of the head width (average of four: 0.29; 0.28; 0.28; 0.31); antennae wholly reddish; last joint of front tarsi swollen but not much elongate; second abdominal segment with one pair of median marginals; otherwise very similar to male.

Length, 7 to 9 mm.

*Type*.—In Vienna Natural History Museum.

Redescribed from 3 male and 12 female specimens from Mexico, Central America, and South America. In the National Museum 10 specimens as follows: 1 male and 1 female from British Guinea, the former labeled "sec type *Exorista sororcula*, J. M. Aldrich," the latter "sec type *Tachina xanthocera*, J. M. Aldrich"; 2 females, San Rafael, Peru (C. H. T. Townsend); 2 females, San Diego, Peru, one labeled "sec type *Exorista rubricornis*, J. M. Aldrich"; 3 females, Itaquaquecetuba, Sao Paulo, Brazil (C. H. Townsend); 1 female, La Providencia, Obispo, Guatemala (C. M. Rouillard); 1 female, Trinidad Rio, Panama (A. Busck). In the American Museum of Natural History: 1 male and 2 females, Chapada, Brazil (H. H.

Smith); 1 male and 1 female, Barro Colorado Island, and Corozal, Canal Zone (C. H. Curran).

(27) *WINTHEMIA BICOLOR*, new species

*Female*.—Front at vertex 0.265 of the head width in the one specimen, widening gradually downward; parafrontals gray pollinose tinged with yellow, beset with scattered fine black hairs; median stripe brownish black, narrowed toward triangle; verticals two pairs; ocellars rather small; orbitals present; frontals about eight in number, the uppermost three in each row large and reclinate, lower ones at or a little below apex of second antennal joint; face very flat, silvery, the sides greatly narrowed or almost linear below, bearing a few black hairs to about the level with tip of antennae; vibrissae large, on oral margin; antennae black, third joint four times the length of second; arista long, slender, with short basal joints; cheeks gray pollinose, sparsely hairy, about one-eighth the eye height; palpi thickened and yellow apically more or less infuscated on basal half.

Thorax black, covered with gray pollen which is thinner and tinged with yellow on mesonotum; the latter marked with five black stripes, the narrower median one distinct before the suture in most angles; scutellum broadly reddish; calypters white with yellow margins.

Abdomen largely reddish; last three segments with thin yellowish pollen on basal half or more; first segment without median marginals; second with a stout pair; a marginal row on third and fourth besides a discal row on the latter; hairs on intermediate segments depressed.

Legs rather slender; femora except at apex reddish yellow; apical joint of front tarsi moderately dilated but shorter than the two preceding joints; mid tibiae with one large bristle on outer front side near middle; hind tibiae with a row of short bristles including one longer on outer posterior side; claws and pulvilli short.

Wings somewhat infuscated especially at base and next to the costa; venation as usual; fourth vein with a rectangular bend, concave beyond to costa; first posterior cell open well before apex of wing; third vein with two hairs at base; costal spine not developed.

Length, 9 mm.

*Male*.—Unknown.

*Type*.—Female, U.S.N.M. No. 43349.

Described from a specimen collected at Itaquaquacetuba, Sao Paulo, Brazil, June 22, by C. H. T. Townsend.

The species is closely related to *pinguis* but differs in having the femora and abdomen largely yellow, the apical joint of the fore



tarsi smaller, and the parafacials narrower. There are other minor differences. The type specimen in the United States National Museum was determined *Hemimasipoda pinguis* by Dr. C. H. T. Townsend.

(28) WINTHEMIA ANALIS Macquart

PLATE 1, FIGURE 7

*Microtrichodes analis* MACQUART, Dipt. Exot., suppl. 1, pp. 288-289, 1846.—BRAUER, Sitzungber. Kais. Mus., vol. 106, p. 367, 1897.

Very similar to *pinguis*, but with the front distinctly broader and with a partial secondary row of frontals outside the main rows below.

*Male*.—Front at vertex 0.323 of the head width in the one specimen. The abdominal cross bands broad as in *pinguis* and in dorsal view occupying about one-half the length of the segments. Venter with sharply defined patches of dense hairs on third and fourth segments. Outer genital forceps yellow, triangular, about two-thirds as long as inner ones, the tips evenly rounded or blunt; inner forceps brownish, united except near apex, keeled behind and tapering uniformly from base outward.

Length, 10 mm.

*Type*.—In collection of J. E. Collin, Newmarket, England.

Redescribed from a single male specimen in the United States National Museum from Rurrenabaque, Beni, Bolivia (Wm. M. Mann, Mulford Exploration). This specimen was compared with the type in 1929 by Dr. J. M. Aldrich. The National Museum contains a second male specimen labeled Catamarca, Argentina, 1927 (Kisliuk 777), which has the same wide front including the partial secondary row of frontal bristles, but the calypters are largely white and the pollen on the abdomen is not disposed in defined cross bands. It is doubtfully included here.

(29) WINTHEMIA SEXUALIS Curran

*Winthemia sexualis* CURRAN, Amer. Mus. Nov. No. 260, p. 7, 1927; Dipt. Porto Rico, p. 109, 1928.

The uppermost frontal bristles stronger than usual, reclinate, situated about in line with anterior ocellus; venter of third abdominal segment with defined patches of dense hairs, none on fourth; hind tibiae sparsely ciliate with one longer bristle in the row near middle. Female sex unknown.

*Male*.—Front 0.212 of the head width in the one specimen, distinctly narrowed before triangle, thence widening rapidly to base of antennae; parafrontals grayish-yellow pollinose to vertex, bearing a few scattered hairs outside of the frontal rows; median stripe

brownish black, exceeding the parafrontal width except at antennae; frontal bristles about 10 in number, extending slightly below base of third antennal joint; ocellars well developed; no orbitals; verticals two pairs, strong; face gray pollinose, the sides grayish yellow, narrow, bearing a median row of 6 to 8 short fine hairs, inconspicuous; antennae black, third joint wider than parafacial, two and one-half times as long as second; arista long, thickened on basal fourth, with a short penultimate joint; palpi reddish yellow; vibrissae situated on level with front edge of mouth; cheeks thinly gray pollinose, black-haired, in profile about one-ninth the eye height; back of head clothed with moderately dense pale gray or whitish hairs.

Thorax black, gray pollinose, with four broad very distinct stripes separated on entire length by pollen bands, the median one widest; scutellum obscurely reddish on apical half, dusted with changeable gray pollen; calypters opaque, white.

Abdomen black in ground color, the sides obscurely tinged with red, apical half of anal segment bright reddish yellow; intermediate segments gray pollinose on basal half or more, the pollen becoming thinner posteriorly with the apices shining in certain views but apparently subpollinose to the hind margin on each; fourth segment with denser gray pollen confined to the basal third above, without any reflecting spots on either side of the median vitta which extends forward interrupting the pollen on segments 3 and 2; hairs rather sparse, depressed except on fourth segment; no median marginal bristles on first segment; second with one pair, strong; third with a marginal row of 8 or 10, large; fourth bearing a subdiscal and a marginal row of smaller bristles; genital segments yellow, small and retracted; genitalia not in position to examine.

Legs moderately stout, black tinged with red; claws and pulvilli elongate; mid tibiae with one stout anterior median bristle.

Wings grayish hyaline but with an apparent brownish tinge all over; rather narrow at base and much longer than the abdomen; fourth vein with a sudden oblique bend, only slightly concave beyond reaching costa well before exact wing tip; third vein with two hairs at base; costal spine very minute.

Length, 7 mm.

*Type*.—Male, in the American Museum of Natural History, from Porto Rico.

Redescribed from a male specimen (paratype) collected at Adjuntos, Porto Rico, June 8–13, 1915 (Lutz and Mutchler), received from C. H. Curran, to whom it is returned.

*Tachina elegans*, also described from Cuba (female only), may prove to be the opposite sex of the present species. I leave the ques-

tion open; it seems impossible to decide except by additional material from the type locality.

(30) *WINTHEMIA PINGUIS* Fabricius

PLATE 1, FIGURES 8 AND 9

*Musca pinguis* FABRICIUS, Syst. Antl., p. 302, 1805.

*Tachina pyrrhopyga* WIEDEMANN, Auss. Zweifl., vol. 2, p. 319, 1830.

*Exorista ruflatra* RONDANI, Nuovi Ann. Sci. Nat. Bologna, p. 9, 1850.—GIGLIOTOS, Ditt. del Mess., ser. 2, pt. 3, p. 37, 1893.

*Chaetolyga erythropyga* BIGOT, Annales, p. 257, 1888.—BRAUER, Sitzungsber. Kais. Mus., vol. 106, p. 348, 1897.—GOWDY, Cat. Ins. Jamaica, p. 83, 1927.

*Masipoda geminata* BRAUER and BERGENSTAMM, Zweifl. Kais. Mus., vol. 4, p. 162, 1889; vol. 5, pp. 402, 430, 1890; vol. 6, p. 123, 1891.—VAN DER WULP, Biologia Dipt., vol. 2, p. 211, 1890.—ALDRICH, Ann. Ent. Soc. Amer., vol. 18, p. 128, 1925, refers to *Winthemia*.

*Exorista latimana* VAN DER WULP, Biologia Dipt., vol. 2, p. 67, pl. 3, fig. 10, 1890.

*Exorista consobrina* VAN DER WULP, Biologia Dipt., vol. 2, p. 68, 1890.

*Heminasipoda brasiliensis* TOWNSEND, Revista Museu Paulista, vol. 15, p. 267, 1926.

*Male*.—Front (before ocelli) 0.225 of the head width (average of four: 0.2; 0.26; 0.19; 0.25); parafrontals yellow pollinose, narrow above widening rapidly downward, beset with short hairs which are thicker near vertex; median stripe brownish red, hardly at all narrowed behind and exceeding the width of one parafrontal at triangle; verticals two pairs; orbitals none; ocellar bristles present though sometimes minute; frontal bristles 10 to 14 in number descending to base of third antennal joint, the uppermost reclinate, stouter than the preceding ones but not very long; face densely gray pollinose, the sides silvery, narrow, and sparsely to moderately black-haired; vibrissae strong, situated on level with oral margin; antennae almost as long as face, black, third joint about three times the length of second; arista unusually long and slender to base, penultimate joint very short; cheeks about one-sixth the eye height, gray pollinose and thickly covered with short black hairs; palpi yellow more or less infuscated basally, beset with numerous black hairs.

Thorax black with gray pollen; mesonotum marked with four subshining black stripes, which are coalescent behind the suture and narrowly separated in front appearing as two broad black bands to the naked eye; scutellum reddish at tip, gray pollinose; calypters opaque, white with a tawny tinge.

Abdomen black in ground color, the sides and apex obscurely reddish; segments 2 to 4 with very distinct grayish pollen bands, which include the basal half or more, the remainder shining, along the median line the pollen is interrupted by an indistinct stripe; first segment without median marginals; second usually without but

sometimes a pair present; third bearing a marginal row of 12 to 14, large; fourth covered with erect hairs in front, bearing numerous bristles on sides near apex besides a marginal row; venter with sharply defined patches of matted glossy-black hairs; genitalia small, retracted; the united inner forceps keeled behind tapering from base to apex, which is shallowly notched; outer forceps yellow, about two-thirds as long as inner ones, not much narrowed before the evenly rounded tips, outer side bearing fine pale hairs.

Legs black; mid tibiae with one large median anterior bristle; hind tibiae ciliate; claws and pulvilli longer than last tarsal joint.

Wings distinctly brown on anterior margin, this color extending rather faintly backward into the first posterior and discal cells, paler behind; fourth vein with an oblique bend ending in costa well before apex of wing; costal spine minute; third vein bearing two or three hairs at base.

*Female*.—Front 0.29 of the head width (average of five: 0.3; 0.29; 0.27; 0.3; 0.29); ocellars strong; two pairs of verticals and orbitals, large; two uppermost frontals stout and reclinate; claws and pulvilli minute, apical joint of fore tarsi conspicuously swollen and approximating the combined length of three preceding joints; hind tibiae with one longer bristle in the outer posterior row; abdomen usually more reddish on sides than in male, second segment with one pair of large median marginals, fourth with a marginal and a subdiscal row.

Length, 7 to 11 mm.

*Type*.—In the Zoological Museum, Copenhagen, Denmark.

Redescribed from numerous specimens of both sexes in the United States National Museum, including 2 males labeled "cotypes *Exorista latimana* van der Wulp"; 1 female paratype *Hemimasipoda brasiliensis* Townsend; 2 males and 1 female determined *Masipoda geminata* by Brauer and Bergenstamm; 1 male labeled "*Masipoda geminata* comp. type, J. M. Aldrich"; and 1 male labeled "type *Tachina pyrrhopyga* Wiedemann," received for study from the Vienna Museum. Distribution records: Teapa, Tabasco, Mexico (H. H. Smith); Sao Paulo, Brazil (C. H. T. Townsend); San Mateo, Costa Rica (Pablo Schild); Posorja, Ecuador (F. Campos); Quirigua, Guatemala (J. M. Aldrich); Ancon, Canal Zone (C. T. Greene); Las Cascadas, Canal Zone (A. H. Jennings); Campinas, Brazil (F. X. Williams); R. Charape and Yahuar Mayo, Peru (C. H. T. Townsend); Coban, Alta Vera Paz, Guatemala (J. M. Aldrich); La Providencia, Obispo, Guatemala (C. M. Rouillard, J. M. Aldrich); Mayaguez, Porto Rico (R. H. Van Zwalenburg); Rurrenabaque, Beni, Bolivia (Wm. M. Mann, Mulford Exploration); Catamarca, Argentina (Kisliuk); Taboga Island and Alhajuelo, Panama (A. Busck); and Barro Colorado Island, Canal Zone (C. T. Greene).

## (31) WINTHEMIA SIGNATA, new species

## PLATE 1, FIGURE 10

Intermediate joints of the front tarsi transversely broadened in male; thoracic stripes fused appearing as two solid black bands to the naked eye; abdomen shining black with defined pollinose cross bands on basal half of segments 2 to 4.

*Male*.—Front 0.245 of the head width (average of four); parafrontals gray pollinose, widening rapidly downward; median stripe brownish black, wider than one parafrontal at the triangle; verticals two pairs: no orbitals; ocellars present, proclinate; frontals descending to base of third antennal joint, not much reduced above, the uppermost two or three pairs reclinate; antennae black, third joint hardly exceeding twice the length of second; arista rather long, only slightly thickened on basal fourth, penultimate joint short; face silvery pollinose, the sides with a few hairs extending downward to the cheeks; the latter faintly pruinose, covered with black hairs, about one-eighth the eye height; vibrissae situated on level with oral margin; palpi black.

Thorax black, pleura lightly dusted with gray pollen shining in certain angles: mesonotum with a median and two broader lateral pollinose stripes; scutellum black the apex obscurely reddish, covered with bluish-gray pollen except near base; with the usual three lateral bristles, besides one discal and a small decussate upturned apical pair; calypters white tinged faintly with yellow.

Abdomen black in ground color, the sides and apical half of fourth segment reddish; basal third to half of segments 2 to 4 with dense gray pollen bands, the remainder of the intermediate segments shining black: first segment without median marginals; second usually with one pair (absent in one specimen); third with a marginal row of about 10; fourth with a discal row and several irregular rows of smaller bristles before apex, destitute of hairs on basal margin above; venter with large roundish defined patches of matted glossy-black hairs on third segment, with similar but smaller patches on the fourth segment: hairs on dorsum of intermediate segments depressed.

Legs black, the intermediate joints of the front tarsi strikingly flattened, about twice as broad as long; mid tibiae with one stout bristle on outer front side near middle; hind tibiae ciliate; claws and pulvilli elongate.

Wings subhyaline, brownish at base and along costal border; fourth vein arcuate beyond bend reaching costa well before apex of wing; third vein with one or two small bristles at base; costal spine small and inconspicuous.

Length, 8.5 to 10 mm.

*Female*.—Unknown.

*Type*.—Male, U.S.N.M. No. 43350, from Lima, Peru.

Described from 6 specimens. Four in the United States National Museum from Lima, Peru, December 27, 1912, and January 11, 1913 (C. H. T. Townsend). Two in the American Museum of Natural History, 1 from Fort Randolph, Canal Zone (C. H. Curran), and 1 from Chapada, Brazil (H. H. Smith).

In the development of the fore tarsi the species approaches *W. okefenokeensis* rather closely but can be separated very readily by the characters mentioned in the key. I have been unable to associate the female sex in the material examined.

(32) *WINTHEMIA OKEFENOKEENSIS* Smith

*Winthemia okefenokeensis* SMITH, Proc. Ent. Soc. Washington, vol. 18, p. 95, 1916.—CURRAN, Dipt. Porto Rico, p. 108, 1928.

*Okea okefenokeensis* SMITH, Townsend, Ins. Insc. Menst., vol. 4, p. 74, 1916.

The intermediate joints of the front tarsi strikingly flattened and obliquely expanded in the male, ordinary in the female; thoracic stripes separated on entire length by pollinose bands of nearly equal width; abdominal segments 2 and 3 gray pollinose or subpollinose to the hind margins.

*Male*.—Front (before ocelli) 0.192 of the head width (average of five: 0.18; 0.19; 0.2; 0.2; 0.19); parafrontals gray pollinose to vertex, moderately haired outside of frontal rows; median stripe not much narrowed behind, at antennae about as wide as one parafrontal; inner verticals moderately developed, the outer ones about three-fourths as long; orbitals none; ocellars rather short but usually quite distinct (absent in one specimen); frontals 10 to 14 in number, extending to level with base of third antennal joint, the upper bristles stopping at apex of triangle not much reduced in size, erect or slightly reclinate; face gray pollinose, the sides more silvery and sparsely haired to near lower extremity; antennae fully three-fourths the length of face, black, the apex of second and base of third joint reddish, the latter one and one-half times the length of second; arista reddish, hardly exceeding the length of antennae, slender beyond proximal third, basal joints short; palpi yellow, more or less infuscated basally and thickly black-haired; cheeks gray pollinose on red ground color, about one-seventh the eye height; beard white.

Thorax black, gray pollinose; mesonotum marked with four broad black stripes, outer ones not interrupted at suture; scutellum red on apical half or more, dusted with uniform gray or whitish pollen; calypters white.

Abdomen with the sides of the three basal segments and the fourth wholly reddish yellow; the gray pollen on the anal segment narrowing from the sides toward the middle above; segments 1 and

2 without any median marginal bristles; third bearing a marginal row of about 10; fourth with a row of smaller bristles near apex and covered in front with erect bristly hairs; venter of third and fourth segments bearing sharply limited patches of dense long black hairs, usually small on the latter; genital segments yellow, small and retracted; inner forceps united and keeled behind, tapering gradually from base to apex, which is slightly bowed forward; outer forceps yellow, hardly two-thirds as long as inner ones, the tips blunt or broadly rounded.

Legs black; mid tibiae with one stout anterior bristle near middle; hind tibiae ciliate; claws and pulvilli exceeding the length of last tarsal joint.

Wings grayish hyaline; first posterior cell open well before wing tip; third vein with one or two hairs at base; costal spine minute.

*Female*.—Front at vertex 0.276 of the head width (average of three: 0.28; 0.27; 0.28), not much wider at base of antennae; the usual two pairs of orbitals present; median stripe uniform in width to triangle and occupying one-third of the frontal width; apical joint of fore tarsi somewhat swollen but not much longer than usual; hind tibiae subciliate with one longer bristle near middle; claws and pulvilli short; abdomen usually showing less red on sides than in male, second segment bearing one pair of median marginals, fourth with a discal and a marginal row.

Length, 6 to 9 mm.

*Type*.—Male, U.S.N.M. No. 20054, from Billys Island, Okefenokee Swamp, Ga.

Redescribed from 10 males (including type) and 3 females in the United States National Museum as follows: 8 males and 1 female, labeled "E E A Cuba 8129"; 1 male and 1 female, Habana, Cuba (Baker), collection of J. M. Aldrich; 1 male, Billys Island, Okefenokee Swamp, Ga., June, 1912 (J. Chester Bradley); 1 female, Spring Creek, Decatur County, Ga., July 16–29, 1912, without collector's label. One female, more robust than the remainder of the series, from Miami, Fla., November 3 (C. H. T. Townsend), is apparently the same.

#### UNRECOGNIZED SPECIES OF WINTHEMIA<sup>2</sup>

The types of all the following species, except Walker's and Bigot's, are apparently lost, and the original descriptions are too inadequate to recognize the forms:

*Exorista leucaniae* KIRKPATRICK, Ohio Agr. Rep. for 1860, p. 757, 1861. Ohio; reared from *Leucania unipuncta*.

*Exorista ostensackenii* KIRKPATRICK, Ohio Agr. Rep. for 1860, p. 757, 1861. Ohio; reared from *Leucania unipuncta*.

<sup>2</sup> *Winthemia obscura* Coquillett, Revis. Tachin., p. 124, 1897, equals *Eupogona* (Aldrich, Proc. Ent. Soc. Washington, vol. 30, p. 44, 1928).

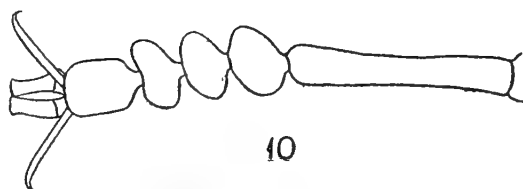
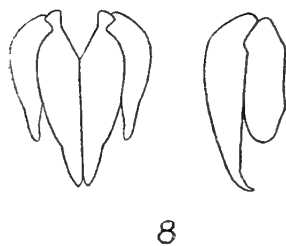
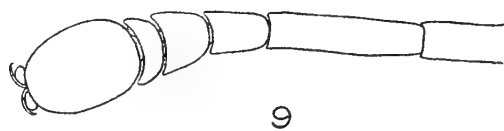
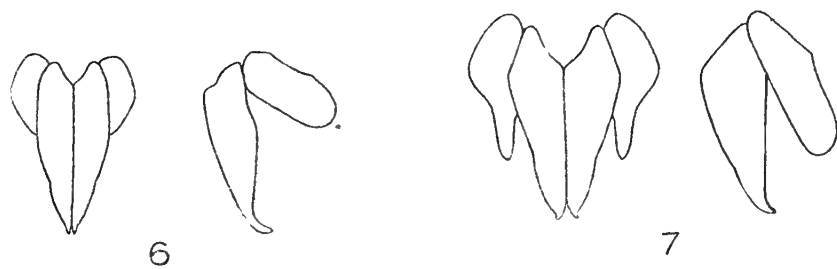
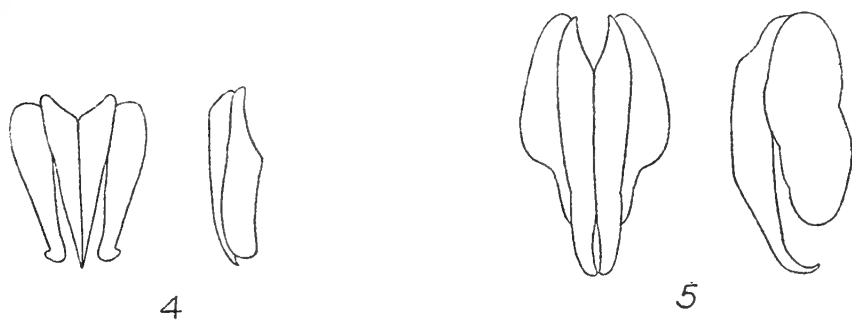
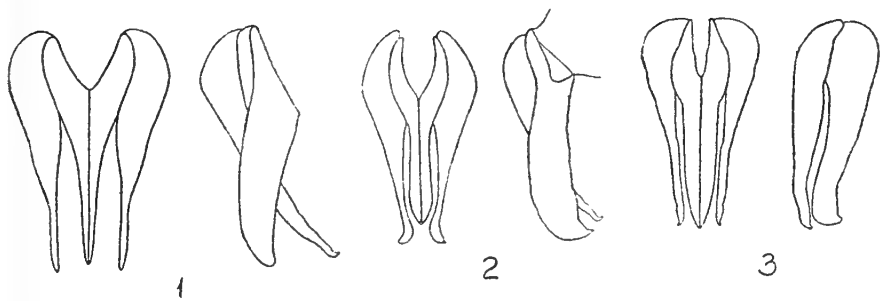
- Senometopia militaris* WALSH, Trans. Illinois State Agr. Soc., vol. 4, pp. 367-8, 1861. Illinois; reared from army worm.
- Tachina picea* WALKER, Ins. Saund., p. 293, 1852. Described from Colombia, South America. The type, a male, is in the British Museum under the name *Chaetolyga*. The following notes were taken from the type by Dr. J. M. Aldrich in 1929: "A large *Winthemia* male, not in best condition. Antennae rather long, second joint wholly red; third brown on upper and apical part. Above vibrissae the small bristles form something of a tuft. Cheek one-eighth to one-tenth of eye height; palpi wholly yellow. Mid tibia with one bristle; hind tibia ciliate. Sternopleural, 1, 1. Front tarsi normal with claws and pulvilli not greatly enlarged. A very marked sexual patch on third segment extending on fourth, with dense brown brush on both. No median marginals on second segment; third with row of 12; fourth segment with numerous bristles on sides and apical half. Calypters white. Third vein with two hairs. Ocellars small; frontals to base of third antennal joint. Length 12.5 mm." It does not seem to be identical with any other species discussed in this paper and appears to be a distinct form of which I have seen no specimens.
- Tachina subpicea* WALKER, Ins. Saund., p. 297, 1852. Described from Brazil. Type in the British Museum as *Chaetolyga*. The latter was also examined by Dr. J. M. Aldrich, whose notes indicate that this form is a synonym of the preceding species.
- Tachina elegans* BIGOT, in Sagra's Cuba, vol. 7, p. 810, 1857. Described from Cuba; the type, a female, is in the collection of J. E. Collin, Newmarket, England. Dr. J. M. Aldrich has also examined this type and states that "the type has no parafacial hairs, but is not in best condition. Fourth abdominal segment red; last joint of front tarsi enlarged, nearly as long as three preceding ones; sternopleurals two; hind tibiae densely ciliated; mid tibiae with one bristle on outer front side near middle." This may prove to be an earlier name for *Winthemia sexualis* Curran, also described (male only) from Cuba.
- Exorista infesta* WILLISTON, Illinois Ent. Rep., p. 65, 1885. Illinois; reared from *Laphygma frugiperda*.
- Exorista platysamiae* TOWNSEND, Trans. Amer. Ent. Soc., vol. 19, p. 288, 1892. Described from a single female specimen reared from *Platysamia cecropia*, Ithaca, N. Y. According to the original description the type has only one proclinate orbital bristle. In the material examined, I have not seen any species in agreement with this character.

#### EXPLANATION OF PLATE 1

(Drawings by Charles T. Greene)

- FIGURES 1-8. Rear and lateral view of male genital forceps, all enlarged:
- 1, *Winthemia montana*, new species; 2, *W. mima*, new species;
  - 3, *W. singularis*, new species; 4, *W. intermedia*, new species; 5, *W. tricolor* van der Wulp; 6, *W. xanthocera* Wiedemann; 7, *W. analis* Macquart; 8, *W. pinguis* Fabricius.
  9. *Winthemia pinguis* Fabricius, front tarsus of female.
  10. *Winthemia signata*, new species, front tarsus of male.





SPECIES OF WINTHEMIA  
FOR EXPLANATION OF PLATE SEE PAGE 54



# SOME TERTIARY MOLLUSKS FROM SOUTHERN FLORIDA <sup>1</sup>

By W. C. MANSFIELD

*United States Geological Survey*

## INTRODUCTION

The interesting molluscan fauna upon which this paper is based was received from Herman Gunter, State geologist of Florida, who kindly gave me permission to study it. The author expresses his sincere thanks to Mr. Gunter for the opportunity to study this fauna and to Mr. G. M. Ponton, assistant geologist of the Florida Geological Survey, for furnishing J. H. C. Marten's description of the locality and section, and to officials of the United States National Museum; to Dr. Henry A. Pilsbry, of the Academy of Natural Sciences of Philadelphia; and to Mr. Carl Boyer, director of the Wagner Free Institute of Science, Philadelphia, for the opportunity to compare specimens with their collections.

The photographs used for illustrations in this paper were made in the laboratory of the United States Geological Survey by W. O. Hazard, and the prints were retouched by Miss Frances Wieser, also of the Geological Survey.

The types of the new species and subspecies and specimens representing nearly all the other species are deposited in the United States National Museum, and a named set of specimens representing topotypes and other species has been deposited with the Florida Geological Survey.

## OCCURRENCE

The fossils herein described were obtained from a ditch along the Tamiami Trail, 42 miles west of Miami, Fla. (east side of sec. 25, T. 54 S., R. 34 E.), half a mile to one mile west of the test well of the Miami Oil & Natural Gas Co., and approximately on the line between Monroe and Dade <sup>2</sup> Counties. The specimens were collected by J. H. C. Martens (1928) and by Herman Gunter and G. M. Ponton (1929).

<sup>1</sup> Published with the permission of the Director of the United States Geological Survey.

<sup>2</sup> According to Florida Geol. Surv. Bull. 6, p. 10, Station No. 25, 1931, in Dade County.

Mr. Martens (then assistant geologist of the Florida Geological Survey) was at the locality while the shovel was working, and the section described by him, with a slight rearrangement, is as follows:

	Feet
3. Unconsolidated sand.....	2
2. Hard yellow limestone, containing many <i>Chione cancellata</i> ...	3
1. Unconsolidated medium-coarse sand with numerous shells; above water.....	1

Mr. Martens observed that only 1 foot of the lower bed was above water, but understood that the shovel was taking similar material at a depth of 6 feet below water level.

All the species listed in this paper are believed to have come from this lowest bed, ranging in a vertical distance from 5 to 12 feet below the surface. The following table gives the species collected, with their relative occurrence and geologic ranges:

Species	Occurrence <sup>1</sup>	Miocene	Pliocene	Recent
<i>Acteocina</i> sp. (corroded).....	r	-----	-----	-----
<i>Bulla</i> sp. cf. <i>B. solida</i> Gmelin.....	r	-----	-----	-----
<i>Myurella</i> sp. cf. <i>M. binodosa</i> Mansfield (fragments).....	r	(?)	(?)	(?)
<i>Conus adversarius</i> Conrad.....	r	x	x	-----
<i>Cymatosyrinx lunata</i> (H. C. Lea).....	r	x	x	-----
<i>Olivella tamiamiensis</i> , new species.....	r	-----	-----	-----
<i>Olivella juspidea gladeensis</i> , new subspecies.....	c	-----	-----	-----
<i>Marginella denticulata</i> Conrad.....	r	x	x	x
<i>Marginella</i> sp. (corroded).....	r	-----	-----	-----
<i>Mitromorpha gunteri</i> , new species.....	r	-----	-----	-----
<i>Busycon</i> sp. (corroded).....	r	-----	-----	-----
<i>Pyramidella</i> sp.....	-----	-----	-----	-----
<i>Trivia</i> sp. cf. <i>T. pediculus</i> Linnaeus.....	r	-----	-----	-----
<i>Cypraea carolinensis floridana</i> , new subspecies.....	c	-----	-----	-----
<i>Caecum floridanum</i> cf. var. <i>compactum</i> Dall.....	r	-----	-----	-----
<i>Caecum cooperi</i> S. Smith.....	r	x	x	x
<i>Vermetus varians</i> d'Orbigny.....	r	(?)	x	x
<i>Turritella pontoni</i> , new species.....	a	-----	-----	-----
<i>Turritella cookei gladeensis</i> , new subspecies.....	a	-----	-----	-----
<i>Crepidula fornicata</i> var. <i>cymbaeformis</i> Conrad.....	r	-----	-----	-----
<i>Natica canrena</i> (Linnaeus) Mörch.....	r	x	x	x
<i>Polinices</i> ( <i>Neverita</i> ) <i>duplicatus</i> (Say).....	r	x	x	x
<i>Tegula</i> ( <i>Omphalius</i> ) <i>exoleta</i> (Conrad)? (corroded).....	r	-----	-----	-----
<i>Liotia</i> ? sp. (young).....	-----	-----	-----	-----
<i>Fissuridea alternata</i> Say? (broken).....	r	-----	-----	-----
<i>Nucula proxima</i> Say.....	c	x	x	x
<i>Glycymeris lloydsmithi floridana</i> , new subspecies.....	r	-----	-----	-----
<i>Arca</i> ( <i>Anadara</i> ) <i>lienosa</i> Say.....	r	x	x	-----
<i>Arca</i> ( <i>Cunearca</i> ) <i>scalaris</i> Conrad, grading toward <i>scalarina</i> Heilprin.....	r	x	-----	-----
<i>Barbatia</i> ( <i>Plagiarca</i> ) <i>candita</i> Gmelin, new sub- species?.....	r	x	(?)	-----
<i>Ostrea sculpturata</i> Conrad.....	r	x	x	-----

<sup>1</sup> a=abundant; c=common; r=rare.

Species	Occurrence	Miocene	Pliocene	Recent
<i>Crassinella dupliniana</i> Dall	r	x	x	
<i>Cardita</i> ( <i>Carditamera</i> ) <i>arata</i> Conrad	c	x	x	
<i>Cardita</i> ( <i>Carditamera</i> ) <i>tamiamiensis</i> , new species	r			
<i>Venericardia</i> ( <i>Pleuromeris</i> ) <i>perplana gladeensis</i> , new subspecies	r			
<i>Venericarda</i> ( <i>Pleuromeris</i> ) <i>tridentata decemcostata</i> Conrad	c	x	x	
<i>Chama</i> sp. cf. <i>C. congregata</i> Conrad	r			
<i>Phacoides</i> ( <i>Here</i> ) <i>pensylvanicus</i> (Linnaeus) var.	c			
<i>Phacoides</i> ( <i>Pseudomiltha</i> ) <i>anodonta</i> (Say)	c	x	x	
<i>Phacoides</i> ( <i>Cardilucina</i> ) <i>trisulcatus</i> (Conrad)	c	x	x	x
<i>Diwaricella</i> sp. (broken)	r			
<i>Diplodonta acclinis</i> (Conrad)	a	x	x	
<i>Bornia</i> sp.	r			
<i>Cardium</i> ( <i>Trachycardium</i> ) <i>evergladeensis</i> , new species	r			
<i>Transennella carolinensis</i> Dall	a	x	x	
<i>Macrocallista nimbosa</i> (Solander)	c	x	x	x
<i>Venus campechiensis</i> Gmelin	r	x	x	x
<i>Gemma trigona</i> Dall	a	x	x	
<i>Parastarte martensi</i> , new species	c			
<i>Tellina</i> sp. (young)				
<i>Tagelus gibbus</i> (Spengler) var.?	r			
<i>Donax</i> sp. (fragments)				
<i>Spisula incrassata</i> (Conrad)	a	x		
<i>Corbula barrattiana</i> Adams var.	r	x	x	
<i>Cadulus quadridentatus</i> Dall?	r			

## CONDITIONS OF DEPOSITION AND NATURE OF FAUNA

The matrix adhering to the outside of the shells and inclosed within them consists of beachlike, medium coarse, rounded, clear quartz grains, indicating a close-shoreline deposit.

The number of species of gastropods and pelecypods with their respective numbers of individuals are fairly well balanced; 25 species of gastropods and 30 species of pelecypods are present.

Some of the shells attained a large size, as *Olivella tamiamiensis*, new species, *Olivella juspidea gladeensis*, new subspecies, *Cardita arata* Conrad, *Cardita tamiamiensis*, new species, and *Venericardia tridentata decemcostata* Conrad.

## RELATION OF THE FAUNA TO A NEAR-BY FAUNA

A collection of fossils obtained along the Tamiami Trail, in Monroe County (sec. 13, T. 54 S., R. 32 E), 9 miles west of Pinecrest (Station 1/1179), were referred to the Pliocene.<sup>2</sup>

This locality is about 13 miles west of that where the fossils were obtained for this paper. The white or light-gray limestone in which the fossils at Station 1/1179 were found was thrown out of shallow ditches to form the roadbed of the Tamiami Trail and carries many individuals of *Ostrea*, *Pecten*, *Spondylus*, and casts of other genera—a fauna unlike that found in the sand to the east. It appears quite probable that the bed at Station 1/1179 either is represented by the 3-foot bed in the section 42 miles west of Miami or is a little older and that the underlying sand in the section is older than the limestone bed at Station 1/1179.

## SUGGESTED AGE OF THE FAUNA

The fauna is tentatively placed in the upper Miocene, although it may represent a Miocene-Pliocene transition or a Pliocene fauna. The relative stratigraphic position of the sand in which the fossils occur has not been fully determined with respect to distant deposits.

The species that indicate a Miocene age rather than a later are as follows: *Cypraea carolinensis floridana*, new subspecies (*C. carolinensis* Conrad appears to be confined to the upper Miocene); *Turritella cookei gladeënsis*, new subspecies (*T. cookei* Mansfield and subspecies occur in the upper Miocene of western Florida); *Arca scalaris* Conrad var. (*A. scalaris* Conrad appears to be confined to the upper Miocene); and *Spisula incrassata* (Conrad), a Miocene species.

The species that indicate a Pliocene age are: *Vermetus varians* d'Orbigny; *Macrocallista nimbosa* (Solander), a species more characteristic of the Pliocene but occurring in the upper Miocene 3 miles southeast of Lumberton, S. C.; *Phacoides pensylvanicus* (Linnaeus) var. (a lower and thinner shell than typical). *P. pensylvanicus* (typical) appears to begin in the Pliocene.

## DESCRIPTIONS OF NEW SPECIES

## OLIVELLA TAMIAMIENSIS, new species

## PLATE 1, FIGURE 3

*Description.*—Shell large, solid, acuminate at posterior end, and consists of 7 whorls. Five early whorls, measuring 2.5 mm. in alti-

<sup>2</sup> Cooke, C. W., and Mossom, Stuart, *Geology of Florida*, 20th Ann. Rep. Florida Geol. Surv., p. 156, 1929.

tude, are broadly conical in outline. Following whorl much larger than preceding and strongly inflated. Body whorl large and subcylindrical in outline. Nucleus consists of one smooth, rounded, porcelaneous, terminally flattened whorl. Suture of postnuclear whorls distinct and channeled. Aperture about half the length of shell. Margins of outer lip broken. A heavy wash of callus lies on the inner lip and extends upward on the body whorl nearly to the suture. Columella, within, provided with one fold situated at its lower border, behind which is a shallow depression. No lirations are visible on the inner lip callus.

*Dimensions*.—Holotype (U.S.N.M. No. 371331) measures: Altitude, 24 mm.; diameter, 10 mm.; length of aperture, 12 mm.

*Type locality*.—Tamiami Trail, 42 miles west of Miami, Fla.

The material at hand consists of two specimens.

The shell of the new species compares in size with the Recent species *Olivella rotunda* Dall, but *O. tamiamiënsis* has a more produced and acuminate spire and lacks the lirations on the inner lip.

**OLIVELLA JUSPIDEA GLADEËNSIS, new subspecies**

PLATE 1, FIGURE 1

*Description*.—Shell large, solid with a moderately acuminate spire, and consists of 6 or 7 whorls. Suture deep, narrow, and channeled. Spire broadly conical; body whorl subcylindrical in outline. Inner lip and face of body whorl provided with a heavy wash of callus. Aperture narrow above and rather wide below. Inner lip callus, except upper area, marked with 18 to 20 lirations.

*Dimensions*.—Holotype (U.S.N.M. No. 371332) measures: Altitude, 23.5 mm.; diameter, 9 mm.; length of aperture, 15 mm.

*Type locality*.—Tamiami Trail, 42 miles west of Miami, Fla.

This subspecies differs from the Recent species *Olivella juspidea* Gmelin in having a stouter shell with a more acuminate spire and longer body whorl.

**MITROMORPHA GUNTERI, new species**

PLATE 2, FIGURE 6

*Description*.—Shell very small, slender, subfusiform, and consists of 1½ nuclear and 4 postnuclear whorls. Suture inconspicuous and shallowly depressed. Apical half turn minute; following turn much larger, smooth, and inflated. Postnuclear spire whorls sculptured with 3 raised, blunt, equisized spirals. The spirals on the two posterior whorls are weakly beaded, while the following spirals are nearly smooth. The space between the posterior and the following

spiral is a little wider than that between the medial and the anterior spiral. Body whorl with 11 spirals, which slightly decrease in strength anteriorly. A very weak spiral lies adjacent to and behind the suture. Very weak axial growth lines intercalate the spirals. Aperture rather narrow; margin of outer lip broken off; within marked with weak entering lirations. Columella bearing two oblique folds, the posterior being much the stronger and situated near the middle of the aperture. The anterior plication is situated near the lower border of the columella.

*Dimensions*.—Holotype (U.S.N.M. No. 371346) measures: Length, 4.2 mm.; diameter, 1.7 mm.; length of aperture, 1.7 mm.

*Type locality*.—Tamiami Trail, 42 miles west of Miami, Fla.

The material consists of one nearly perfect specimen—the holotype—and a fragment of another shell.

The new species differs from *Mitromorpha pygmaea* Dall, a Pliocene species, in having a more slender shell, which is sculptured on the spire whorls with three spirals instead of four. *Mitromorpha mitrodita* Gardner and Aldrich, a species occurring in the Duplin marl, N. C., has axial costae and four spirals on the spiral whorls.

#### CYPRAEA CAROLINENSIS FLORIDANA, new subspecies

##### PLATE 1, FIGURES 2, 6, 7

*Description*.—Shell rather large, solid, and subelliptical in outline. Dorsal area well rounded; ventral area slightly rounded. Aperture wide, more expanded below than above. Posterior commissure wide and deep. Teeth strongly developed on both lips. The holotype has 24 teeth on the outer lip and 17 on the inner. The number of teeth on the outer lip of paratype specimens ranges from 21 to 24, and on the inner lip, 16 to 18.

*Dimensions*.—Holotype (U.S.N.M. No. 371333) measures: Length, 80 mm.; diameter, 48 mm.; dorso-ventral diameter, 34.5 mm. Figured paratype measures: Length, 69 mm.; diameter, 45.5 mm.; dorso-ventral diameter, 23 mm.

*Type locality*.—Tamiami Trail, 42 miles west of Miami, Fla.

The subspecies differs from *Cypraea carolinensis* Conrad in having a more rounded ventral area. One specimen collected by the writer from the Duplin marl at Station 11831, 5 miles west of Faison, Sampson County, N. C., agrees in detail with the Florida specimens.

#### TURRITELLA PONTONI, new species

##### PLATE 2, FIGURES 4, 5, 7

*Description*.—Shell rather large, solid, acute, having an apical angle of  $19^{\circ}$  and consisting of 11 whorls on the holotype. Whorls



are more expanded at the anterior end than posterior, and wind against the base of the preceding whorl. Earliest  $1\frac{1}{2}$  turns smooth and inflated; the following 4 to 5 turns are medially carinate; and the following turns are marked by two spiral carinae, which are more prominent on the earlier than later whorls. The lower carina marginates the precipitous base and gradually increases in strength in ascending the whorl. Aside from the carinae, there are 12 to 16 moderately strong, subrounded primary spiral threads on each whorl, which are more closely spaced on the early whorls than on the later whorls. Two to three threadlets intercalate the primary spirals. Aperture subovate in outline.

*Dimensions*.—Holotype (U. S. N. M. No. 371335) measures: Altitude, 66 mm.; greatest diameter, 21 mm.

*Type locality*.—Tamiami Trail, 42 miles west of Miami, Fla.

Some of the broken specimens represent larger shells than the holotype; one of these measures 33 mm. in diameter.

The new species is named for Gerald M. Ponton, of the Florida Geological Survey.

It is nearly related to *Turritella gatunensis* Toulou but differs from the latter in having a greater apical angle and weaker and more rounded spirals on the posterior slope.

*Turritella alcida* Dall, a species occurring in the Oak Grove sand of the Alum Bluff group, is similar in outline and in sculpture to *T. pontoni* but differs from it in having wider-spaced carinae and more closely spaced spirals.

**TURRITELLA COOKEI GLADEËNSIS, new subspecies**

**PLATE 2, FIGURES 1, 2, 3**

*Description*.—Shell rather large, acute, the apical angle being about  $18^\circ$ , and consists of 14 whorls on the broken holotype, probably originally about 20 whorls. Suture grooved but not deeply impressed. Anterior one to two whorls on some specimens rounded in outline and much more expanded than preceding. Apical whorl rather small, smooth, and nearly rounded in outline; following 8 to 10 whorls medially depressed and ornamented mainly by two crenulated spirals, the anterior being the stronger and first to originate. On the later whorls there are 6 spirals. In ascending the whorl, the first and third spirals are weak and about equal in strength; the second and fourth are a little stronger; the fifth is the strongest spiral and forms the periphery of the whorl; and the basal spiral is weaker than the preceding and lies closely against the suture. All the spirals except the basal one are crenulated. The surface of the shell is marked by spiral threadlets, which overrun the spirals and interspaces.

*Dimensions*.—Holotype (U.S.N.M. No. 371337) measures: Altitude 58 mm.; greatest diameter, 17 mm.

*Type locality*.—Tamiami Trail, 42 miles west of Miami, Fla.

*Turritella cookei gladeënsis* is most closely allied to *T. c. harveyensis* Mansfield, an upper Miocene subspecies, differing mainly from the latter in having a more strongly developed peripheral spiral. *T. burdenii* (Tuomey and Holmes), an upper Miocene species, also is closely allied to *gladeënsis*, but the former also has a less strongly developed peripheral spiral.

GLYCYMERIS LLOYDSMITHI FLORIDANA, new subspecies

PLATE 3, FIGURES 4, 5

*Description*.—Shell small, subovate, slightly inequilateral, and rather strongly inflated. Beak high, narrow, and protruding. Middle of disk well rounded; slopes subtruncate, anterior more truncate than posterior. Posterior margin more rounded than anterior; basal margin narrowly rounded. Sculpture of 31 subrounded to nearly flat, moderately wide, closely set ribs, separated by narrow incised spaces. A few ribs behind the posterior shoulder have a low, medial, raised, radial thread. Cardinal area 1.9 mm. wide and sculptured with 5 chevron-shaped ligamental grooves. There are 11 arched teeth in each series behind and in front of the beak. The first posterior tooth, situated beneath the beak, is wider than the others and shallowly corrugated. The teeth in the middle of each series are stronger than those at either end. The lower inside margin shows 20 doubled prominences, separated by valleys equal in width to the prominences.

*Dimensions*.—Holotype, left valve (U.S.N.M. No. 371339) measures: Length, 18 mm.; altitude, 19 mm.; semidiameter, 6 mm.

*Type locality*.—Tamiami Trail, 42 miles west of Miami, Fla.

The shell here described appears to be very closely allied to *Glycymeris lloydsmithi* Pilsbry and Brown, a species obtained from the Miocene in the neighborhood of Cartagena, Colombia. The cardinal area on *G. lloydsmithi* is much narrower than that of *G. l. floridana* and has a nearly smooth surface. Dr. A. A. Olsson<sup>3</sup> records the occurrence of *G. lloydsmithi* at three localities "in the Gatun stage in Costa Rica." I have not seen specimens from these localities, but the illustrations indicate a somewhat more oblique shell than that of *floridana*. The new subspecies more closely resembles *G. subovata* (Say) in sculpture and *G. pectinata* (Gmelin) in outline.

There are only two left valves of the new subspecies at hand, one of which constitutes the holotype.

<sup>3</sup> Olsson, A. A., Bull. Amer. Pal., vol. 9, p. 353, pl. 28, figs. 8-10, 1922.

## CARDITA (CARDITAMERA) TAMIAMIENSIS, new species

## PLATE 3, FIGURES 1, 2, 3

*Description*.—Shell very large, heavy, strongly inflated, and subquadrate in outline. Middle of shell and anterior side well rounded in outline; posterior side steeply descending. Sculpture of 17 ribs, thin and high over the umbonal region and thick and heavy over the ventral area. The ribs over the middle and anterior side of the shell are ornamented with thin, erect, transverse lamellae and over the posterior shoulder and posterior side by scabrous lamellae. The lateral tooth is strong. The lower inside margin is marked with wide crenulations.

*Dimensions*.—Larger cotype, left valve (U. S. N. M. No. 371341) measures: Length, 57 mm.; altitude, 42 mm.; semidiameter, 20 mm. Smaller cotype, length, 46 mm.; altitude, 30 mm.; semidiameter, 13 mm.

*Type locality*.—Tamiami Trail, 42 miles west of Miami, Fla.

This species is very similar in outline and convexity to *Cardita* (*Carditamera*) *floridana* Conrad, described from the Recent fauna of the coast of Florida, but in size it is twice as large as the largest specimen I have seen of the Recent species. The ribs over the umbonal area of the new species are much higher and thinner than those on the Recent species and lack the strong beaded ornamentation. *C. (C.) tamiamiensis* appears to be an ancestral form of *C. floridana*.

Only three left valves of the new species are at hand.

## VENERICARDIA (PLEUROMERIS) PERPLANA GLADEËNSIS, new subspecies

## PLATE 4, FIGURES 2, 5

*Description*.—Shell very small, moderately solid, rather low, obliquely subovate, inequilateral, the anterior side being much longer. Anterior side of disk much higher than posterior side. Sculpture of 15 closely spaced ribs, more distinct and very weakly granulated over upper half of disk and indistinct over lower half. Reflected concentric lamellae ornament the vertical half of the disk. Lunule and escutcheon well defined, smooth, and lanceolate. Internal margin rather coarsely crenulated.

*Dimensions*.—Holotype, left valve (U.S.N.M. No. 371342), measures: Length, 3 mm.; altitude, 3.2 mm.

*Type locality*.—Tamiami Trail, 42 miles west of Miami, Fla.

The material consists of three left valves, one of which constitutes the holotype.

*V. (P.) perplana gladeënsis* is most closely allied to *V. (P.) p. abbreviata* (Conrad), a form described from the upper Miocene at Wil-

mington, N. C., but its shell is narrower, is more elevated over the anterior side, and is sculptured with less distinct radials.

**CARDIUM (TRACHYCARDIUM) EVERGLADEËNSIS, new species**

PLATE 4, FIGURES 1, 3, 9

*Description.*—Shell rather small, solid, subquadrate, slightly oblique, and moderately inflated. Middle of shell and anterior side rounded; posterior side more steeply declining. Anterior margin broadly rounded, ventral margin narrowly rounded, posterior margin nearly straight. Sculpture of 29 to 31 (on the holotype 31) nearly flat, narrow, high ribs, which are separated by moderately narrow spaces over the middle of the disk and more closely spaced over the sides. Crest of ribs ornamented with thin, nearly erect, marginally reflected funnel-shaped structures, which are more closely spaced on the anterior side than on posterior. The surfaces of the ribs are corroded over the middle of the shell and only the basal parts are revealed. A patch of callus covers the inside of the shell.

*Dimensions.*—Holotype, left valve (U.S.N.M. No. 371343), measures: Length, 34 mm.; altitude, 39 mm.; semidiameter, 15 mm.

*Type locality.*—Tamiami Trail, 42 miles west of Miami, Fla.

*Cardium (Trachycardium) evergladeënsis* most closely resembles *C. isocardia* Linnaeus in outline but differs from it in having a more quadrate shell. The character of the sculpture on the ribs is also different.

The material at hand consists of only two left valves, one of which constitutes the holotype.

**PARASTARTE MARTENSI, new species**

PLATE 4, FIGURES 4, 6, 7, 8

*Description.*—Shell very small, trigonal, moderately convex, slightly inequilateral and oblique. Beaks rather low, pointed, and anteriorly directed. Back of valves gently rounded, sides precipitous. Posterior margin very broadly rounded and longer than anterior; anterior margin nearly straight except at lower part, where it curves outward; ventral margin broadly rounded. Lunule large, lanceolate, bounded by distinct lines, and longitudinally crossed by fine threads. External sculpture of moderately fine, slightly raised concentric lamellae. Hinge with three cardinals, the middle tooth in each valve being the strongest. Posterior lateral margin of right valve and anterior lateral margin of left valve sulcated to receive the edge of the opposite valve. Inside ventral margin not crenulated.

*Dimensions*.—Cotypes (U.S.N.M. No. 371344) measure: Right valve, length, 2.7 mm.; height, 2.7 mm. Left valve, length, 2.7 mm.; height, 2.7 mm.

*Type locality*.—Tamiami Trail, 42 miles west of Miami, Fla.

*Parastarte martensi* appears to be more closely allied to the forms that have been referred to the genus *Parastarte* than to those referred to the genus *Gemma*. The concentric sculpture suggests the genus *Gemma*, but the other features are more like those of *Parastarte*.

## EXPLANATION OF PLATES

(Figures represent the natural size of the specimens unless otherwise indicated on the plates)

### PLATE 1

FIGURE 1. *Olivella juspidea gladeënsis*, new subspecies. Holotype.

2, 6, 7. *Cypraea carolinensis floridana*, new subspecies: 2, Back view of holotype; 6, front view of paratype (U.S.N.M. No. 371334); 7, front view of holotype.

3. *Olivella tamiamiënsis*, new species. Holotype.

4, 5. *Gemma?* new species? (U. S. N. M. No. 371345). A unique specimen that is too small to determine the genus.

### PLATE 2

FIGURES 1, 2, 3. *Turritella cookei gladeënsis*, new subspecies: 1, Holotype; 2, 3, paratypes (U. S. N. M. No. 371338).

4, 5, 7. *Turritella pontoni*, new species: 4, 5, Paratypes (U.S.N.M. No. 371336); 7, holotype.

6. *Mitromorpha gunteri*, new species. Holotype.

### PLATE 3

FIGURES 1, 2, 3. *Cardita (Carditamera) tamiamiënsis*, new species. Cotypes. 1, Exterior of smaller valve; 2, 3, interior and exterior of larger valve.

4, 5. *Glycymeris lloydsmithi floridana*, new subspecies. Holotype, interior and exterior of same valve.

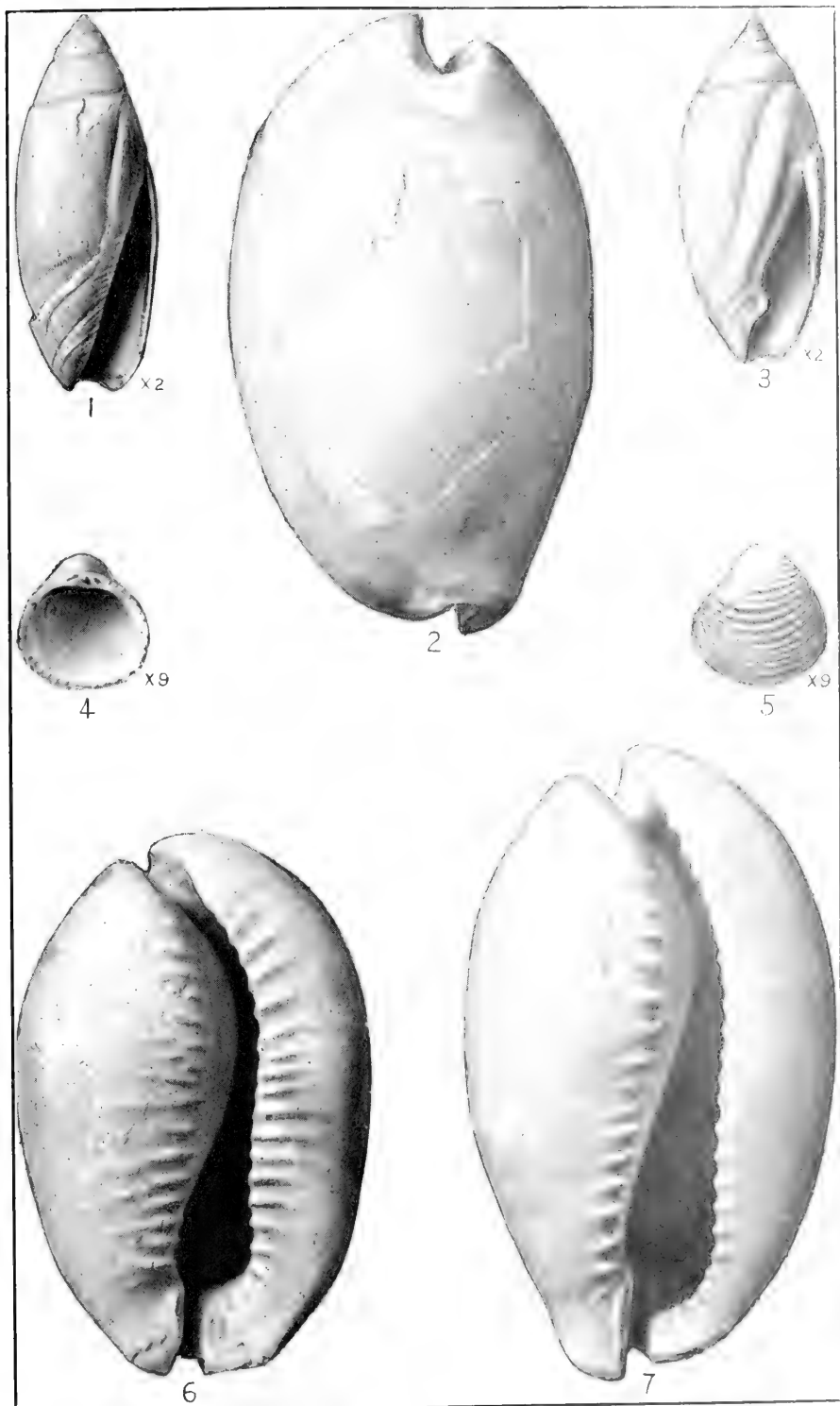
6. *Cardita (Carditamera) arata* Conrad. Exterior of left valve of a large specimen, U.S.N.M. No. 371340.

### PLATE 4

FIGURES 1, 3, 9. *Cardium (Trachycardium) evergladeënsis*, new species. Holotype. 1, 3, Interior and exterior of same valve; 9, character of ornamentation on anterior side of outside.

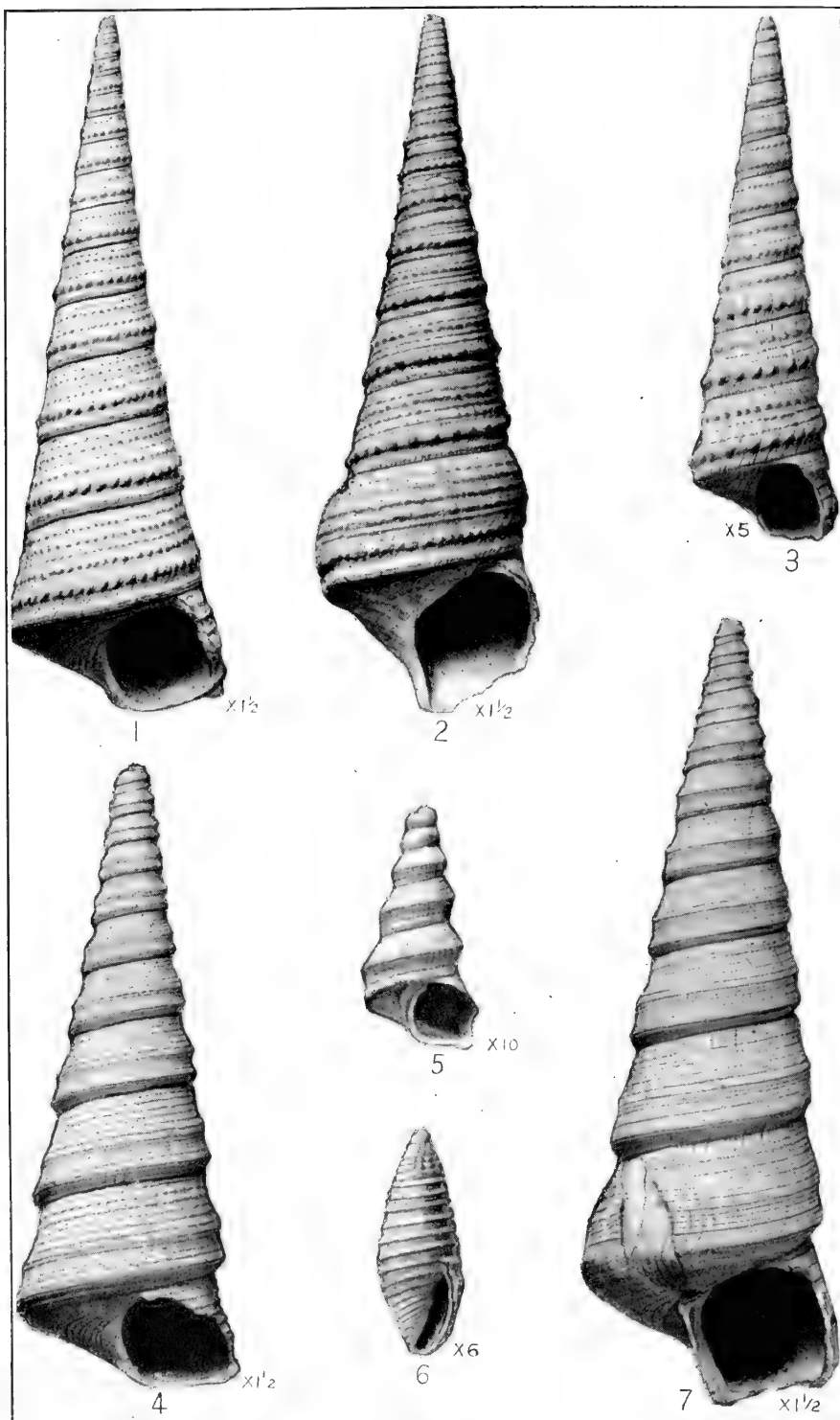
2, 5. *Venericardia (Pleuromeris) perplana gladeënsis*, new subspecies. Holotype, exterior and interior of same valve.

4, 6, 7, 8. *Parastarte martensi*, new species. Cotypes. 4, 6, Same valve; 7, 8, same valve.



SPECIES OF OLIVELLA, CYPRAEA, AND GEMMA (?)

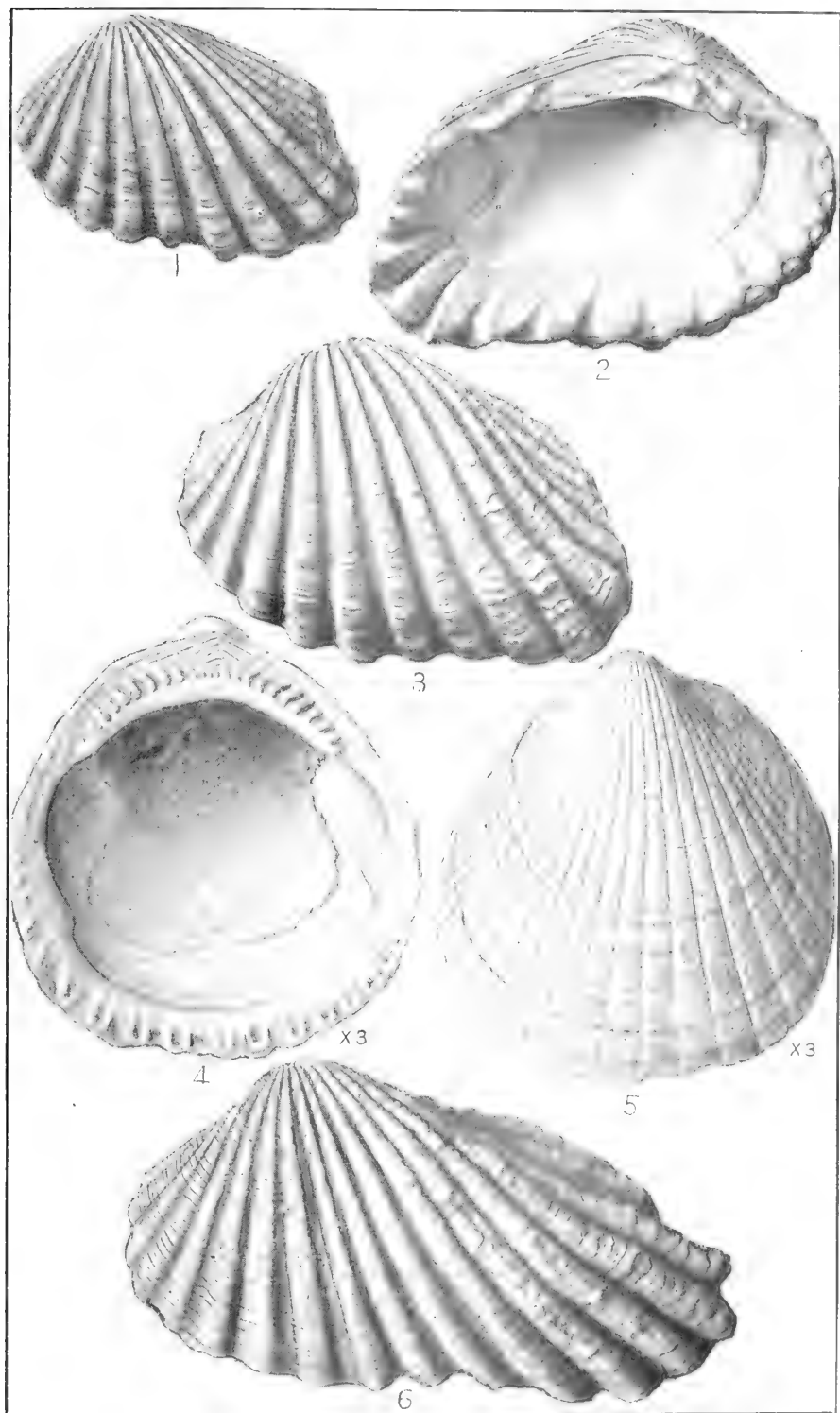
FOR EXPLANATION OF PLATE SEE PAGE 12.



SPECIES OF TURRITELLA AND MITROMORPHA

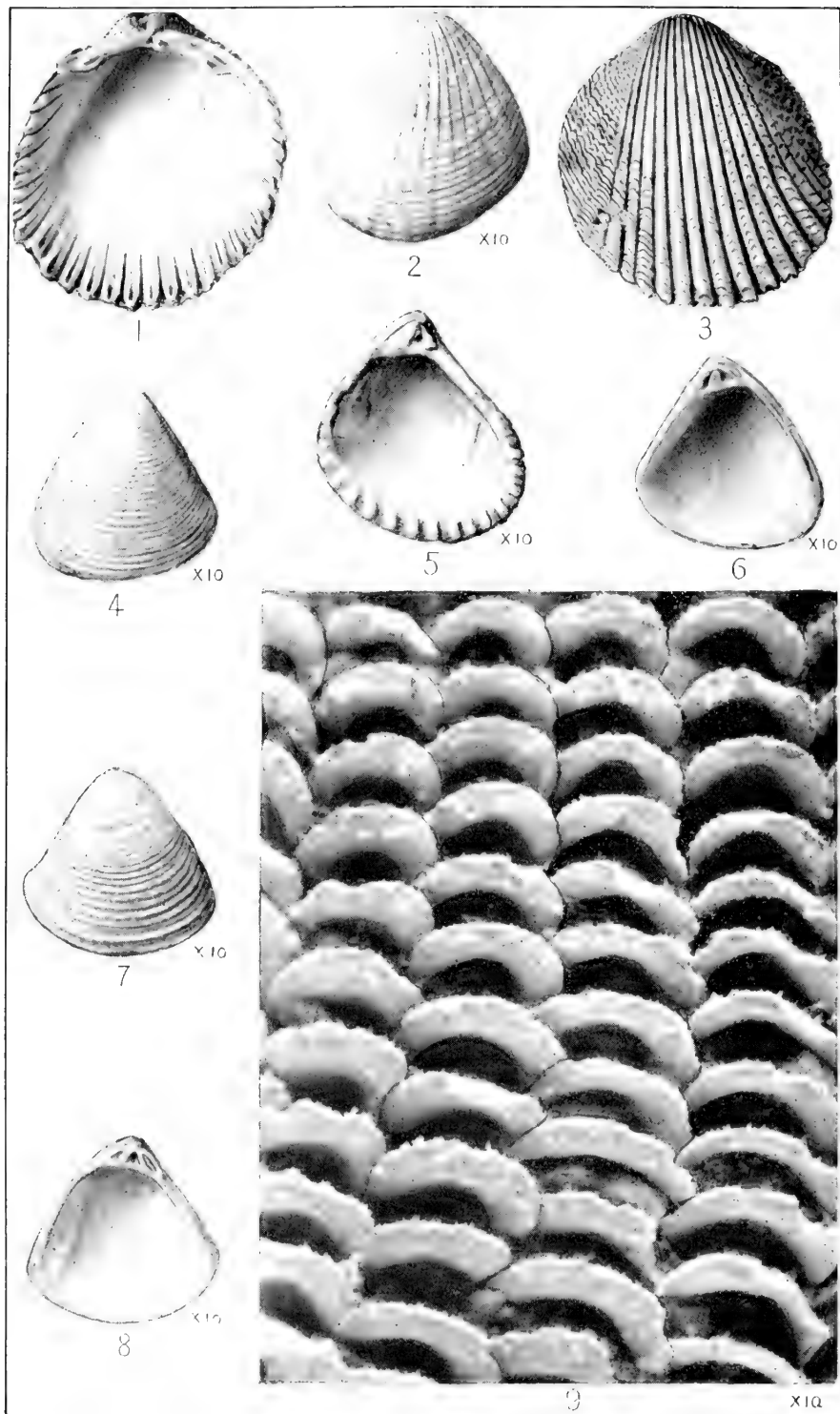
FOR EXPLANATION OF PLATE SEE PAGE 12.





SPECIES OF *CARDITA* AND *GLYCYMERIS*

FOR EXPLANATION OF PLATE SEE PAGE 12.



SPECIES OF *CARDIUM*, *VENERICARDIA*, AND *PARASTARTE*

FOR EXPLANATION OF PLATE SEE PAGE 12.

# THE STEGOCEPHALID AND AMPELISCID AMPHIPOD CRUSTACEANS OF NEWFOUNDLAND, NOVA SCOTIA, AND NEW BRUNSWICK IN THE UNITED STATES NATIONAL MUSEUM

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Museum

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The Stegocephalidae are represented in the collection of the United States National Museum by three genera comprising four species. *Stegocephalus inflatus* has for many years been known from the coast of Labrador, the Gulf of St. Lawrence, and the New England coast, so that its occurrence in the region under discussion was to be expected. *Phippsiella similis*, described from the west coast of Norway, now appears for the first time in the Western Hemisphere. *Phippsiella minima* and *Andaniella pectinata* have been recorded from the west coast of Greenland, but not heretofore directly from the east coast of North America.

Three genera of the family Ampeliscidae, *Ampelisca*, *Byblis*, and *Haploops*, are represented in the amphipod fauna of this region. *Ampelisca macrocephala*, *A. eschrichtii*, *A. spinipes*, *Byblis gaimardii*, and *Haploops setosa* have all been recorded previously from the New England coast. *Ampelisca aequicornis*, *A. latipes*, *A. amblyops*, *A. gibba*, and *Haploops similis* are now recorded for the first time from the eastern coast of North America, and *Ampelisca typica* makes its initial appearance in the Western Hemisphere.

A form that superficially resembles *Haploops tubicola* and that has been mistaken for that species, I have described as a new species, *Haploops spinosa*. *H. tubicola* occurs in the Gulf of St. Lawrence, but I have not observed it among any of the material in the National Museum that was taken south of the gulf.

## Family STEGOCEPHALIDAE

### STEGOCEPHALUS INFLATUS Kröyer

1842. *Stegocephalus inflatus* KRÖYER, Naturh. Tidsskr., vol. 4, p. 150.

1891. *Stegocephalus inflatus* G. O. SARS, Crustacea of Norway, vol. 1, p. 198, pl. 69.

Location 47 steamer *Speedwell*, SE. 1/2 S. from Cape Sable about 22 miles, August 21, 1877, 59 fathoms, pebbles and sand; 1 specimen.

Location 80 steamer *Speedwell*, Chebucto Light, N.  $1\frac{1}{2}$  E. 9 miles, September 5, 1877, 57 fathoms, mud and pebbles; 1 specimen.

Station 2459 steamer *Albatross*, southeast of Newfoundland,  $46^{\circ} 23' 00''$  N.,  $52^{\circ} 45' 00''$  W., July 2, 1885, 88 fathoms, coarse gray sand; 1 specimen.

Station 2466 steamer *Albatross*,  $45^{\circ} 29' 00''$  N.,  $55^{\circ} 24' 00''$  W., July 3, 1885, 67 fathoms, coral; 8 specimens.

Station 2469 steamer *Albatross*, east of Nova Scotia,  $44^{\circ} 58' 37''$  N.,  $56^{\circ} 20' 45''$  W., July 4, 1885, 201 fathoms, green mud; 1 specimen.

This species has been recorded frequently from the New England coast as far south as Block Island, and the *Challenger* took it south of Halifax in May, 1873.

#### PHIPPSIELLA SIMILIS (G. O. Sars)<sup>1</sup>

1891. *Stegocephalus similis* G. O. SARS, Crustacea of Norway, vol. 1, p. 200, pl. 70, fig. 1.

1924. *Phippsiella similis* SCHELLENBERG, Mitteil. Zool. Museum in Berlin, Band 11, Heft 2, p. 200.

1925. *Phippsiella similis* STEPHENSEN, Danish *Ingolf*-Expedition, vol. 3, pt. 9. Crust. Malacost. VI. Amphipoda. II. p. 131.

Station 2429 steamer *Albatross*,  $42^{\circ} 55' 00''$  N.,  $50^{\circ} 51' 00''$  W., June 23, 1885, 471 fathoms, gray mud; 2 specimens.

This species was taken by the *Ingolf* in Davis Strait, making the first record for American waters. The present record extends the range very greatly southward.

#### PHIPPSIELLA MINIMA Stephensen

##### FIGURES 1, 2

1925. *Phippsiella minima* STEPHENSEN, Danish *Ingolf*-Expedition, vol. 3, pt. 9. Crust. Malacost. VI. Amphipoda. II. p. 131, fig. 37.

Station 2466 steamer *Albatross*, south of Newfoundland,  $45^{\circ} 29' 00''$  N.,  $55^{\circ} 24' 00''$  W., July 3, 1885, 67 fathoms, coral; 1 specimen.

This species bears a very striking superficial resemblance to *Phippsiella similis* (Sars) but upon close examination it is found to differ in important characters. The specimen that I have examined also differs somewhat in a few characters from the description and figures given by Stephensen, but this I believe to be due to the very immature condition of the specimens he had at his disposal.

The *Ingolf* Expedition took this species off western Greenland in latitude  $64^{\circ} 54'$  N.; the present record, therefore, extends the range considerably to the south.

<sup>1</sup> Schellenberg, in Bull. Mus. Comp. Zoöl., vol. 69, no. 9, pp. 196, 197, 1929, has given an excellent key to the genera of the Stegocephalidae, but the characters for the genera *Phippsiella* and *Stegocephalopsis* have been accidentally transposed.

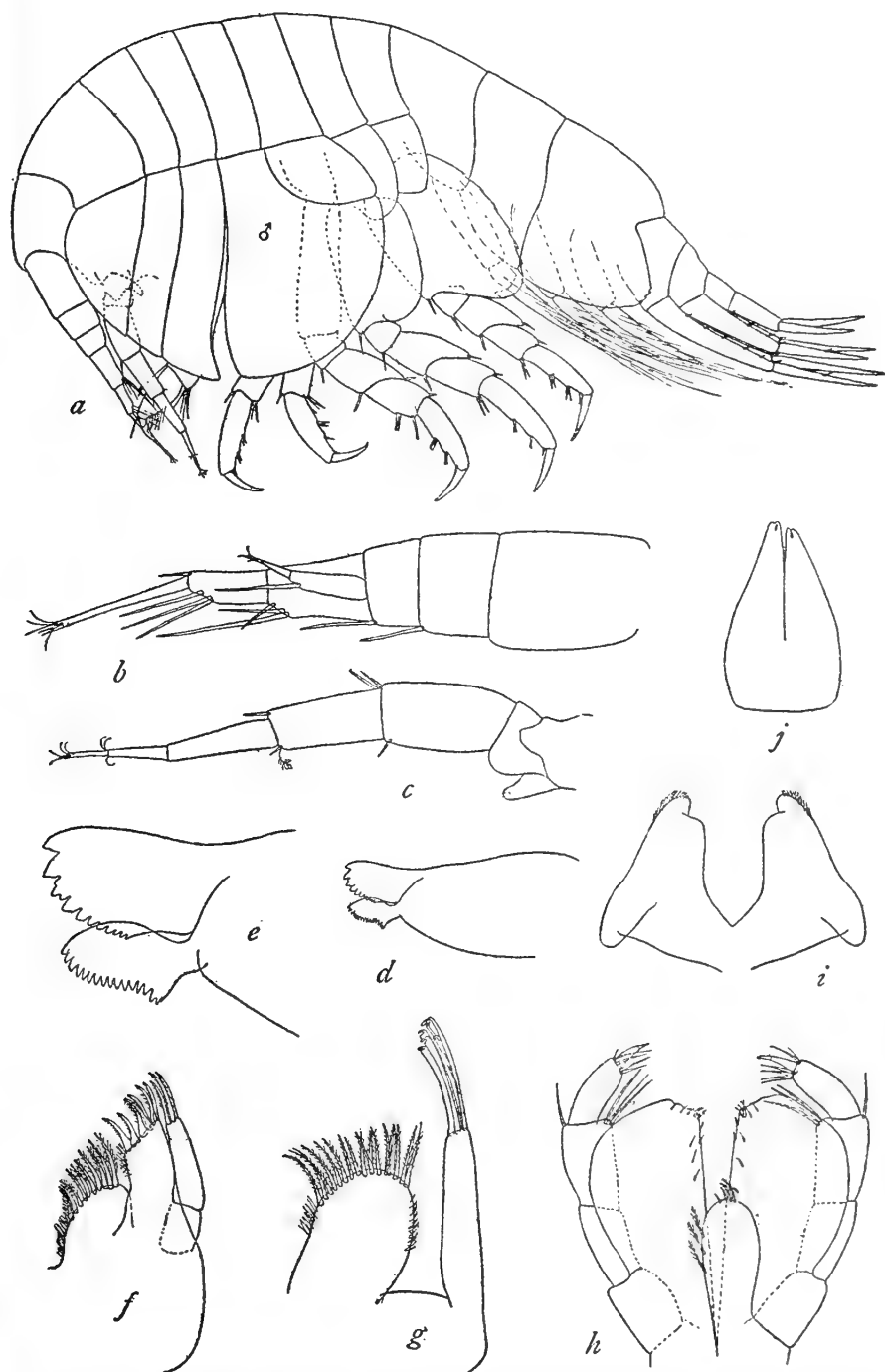


FIGURE 1.—*Phthypsiella minima* Stephensen. Male. *a*, Entire animal; *b*, antenna 1; *c*, antenna 2; *d*, left mandible; *e*, primary and secondary cutting plates of mandible enlarged; *f*, maxilla 1; *g*, maxilla 2; *h*, maxillipeds; *i*, lower lip; *j*, telson

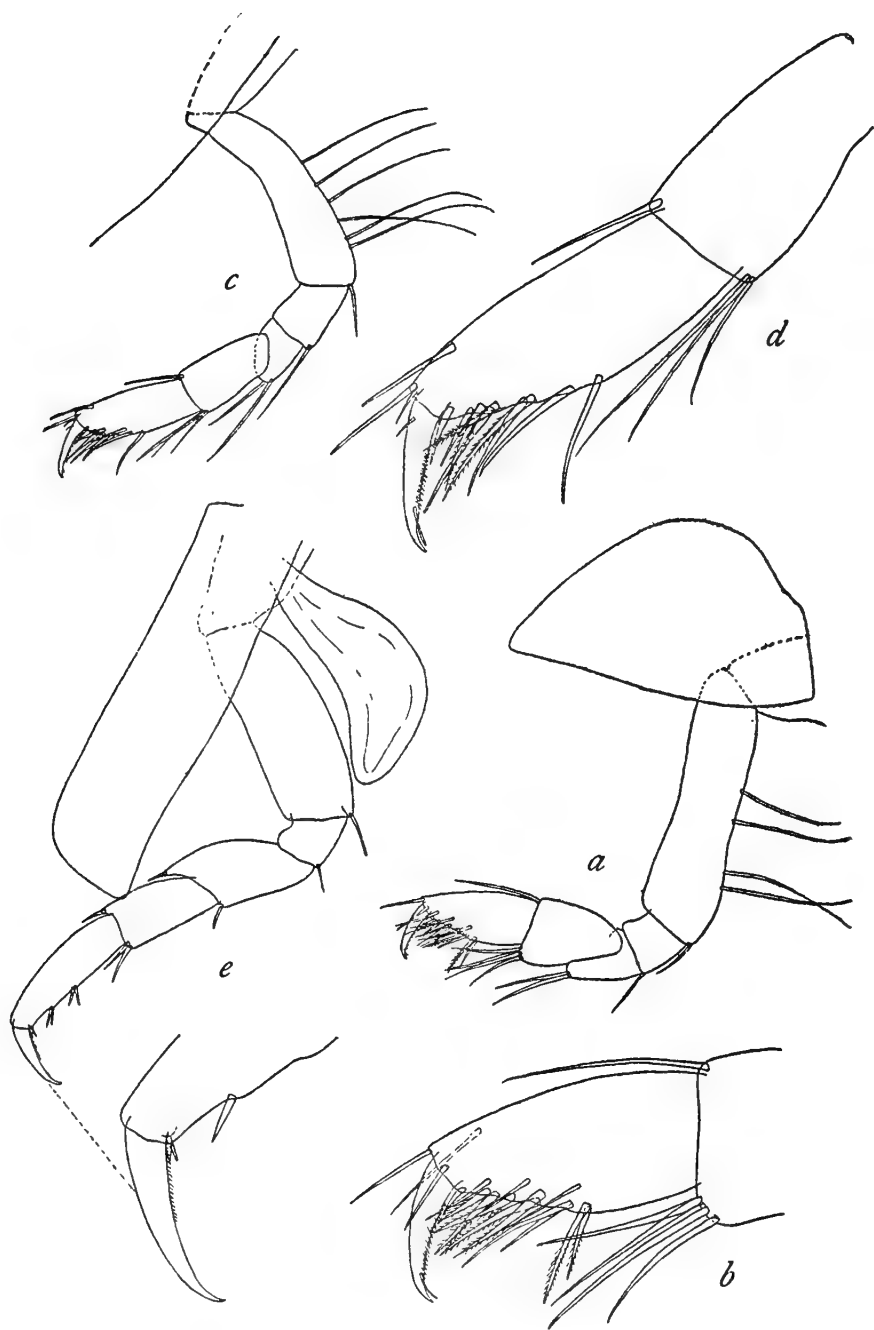


FIGURE 2.—*Phippsiella minima* Stephensen. Male. *a*, Gnathopod 1; *b*, sixth and seventh joints of gnathopod 1 enlarged; *c*, gnathopod 2; *d*, sixth and seventh joints of gnathopod 2 enlarged; *e*, peraeopod 1

Stephensen states that there are very few joints in the flagella of the antennae, but that the apices are lost. In the present male specimen, which measures 5.5 mm., antenna 2 projects slightly beyond antenna 1. In antenna 1 the first joint of the peduncle is longer than the second and third joints combined; the flagellum, which is slightly longer than the peduncle, is composed of three joints, the last of which is very slender and nearly as long as the first and second combined; the accessory flagellum is longer than the first joint of the primary flagellum and is composed of two joints, the second of which is more than half the length of the first but much slenderer; from the under side of the first of these joints near the extremity projects a long slender spine, which reaches considerably beyond the end of the second joint. The first and second joints of the primary flagellum also bear long slender spines on their under surfaces near their extremities. In antenna 2 the fifth joint of the peduncle is nearly as long as the fourth; the 3-jointed flagellum is nearly as long as the fourth and fifth peduncular joints combined; the first joint of the flagellum is slightly longer than the second and third combined. The mandible has the cutting edge very heavily toothed, and bears a secondary plate, which is nearly as large and strongly toothed as the primary. The palp and outer plate of maxilla 1 are as figured by Stephensen, the inner plate is much shorter and broader than the outer, and its convex edge bears a row of plumose setae. He states that maxilla 2 is exactly as in *Phippsia gibbosa* (Sars),<sup>2</sup> but in the present specimen the inner plate is shorter and broader with the extremity evenly convex, and not obliquely truncate as figured by Sars; the spines at the apex of the outer plate are, however, as Stephensen describes them.

The maxillipeds are said to be as in *Stegocephalus inflatus* Kröyer, but the palp appears to be stouter and shorter, and the inner and outer plates longer, the outer reaching beyond the end of the second joint of the palp. The proximal half of the inner edge of all the pereopods is armed with a row of minute spinules. The very minute notch in the rounded hind corner of the third pleon segment Stephensen believed to be due to accidental damage, but the present specimen bears three small serrations at this corner. The telson is as figured by Stephensen.

#### ANDANIELLA PECTINATA (G. O. Sars)<sup>3</sup>

FIGURES 3, 4

1882. *Andania pectinata* G. O. Sars, Forhandl. Vidensk.-Selskab. Christiania, no. 18, p. 86, pl. 3, fig. 9a, b.

1891. *Andaniella pectinata* G. O. Sars, Crustacea of Norway, vol. 1, p. 211, pl. 72, fig. 3.

<sup>2</sup> Crustacea of Norway, vol. 1, pl. 71, fig. 1, 1891.

<sup>3</sup> Schellenberg, in Bull. Mus. Comp. Zool., vol. 69, no. 9, p. 197, 1929, has in his key to the genera of the family Stegocephalidae accidentally transposed the characters for *Andanotopis* and *Andaniella*.

1925. *Andaniella pectinata* STEPHENSEN, Danish *Ingolf-Expedition*, vol. 3, pt. 9. Crust. Malacost. VI. Amphipoda. II. p. 137.

Station 2466 steamer *Albatross*, south of Newfoundland,  $45^{\circ} 29' 00''$  N.,  $55^{\circ} 24' 00''$  W., July 3, 1885, 67 fathoms, coral; 2 specimens, 1 ♂ and 1 ♀.

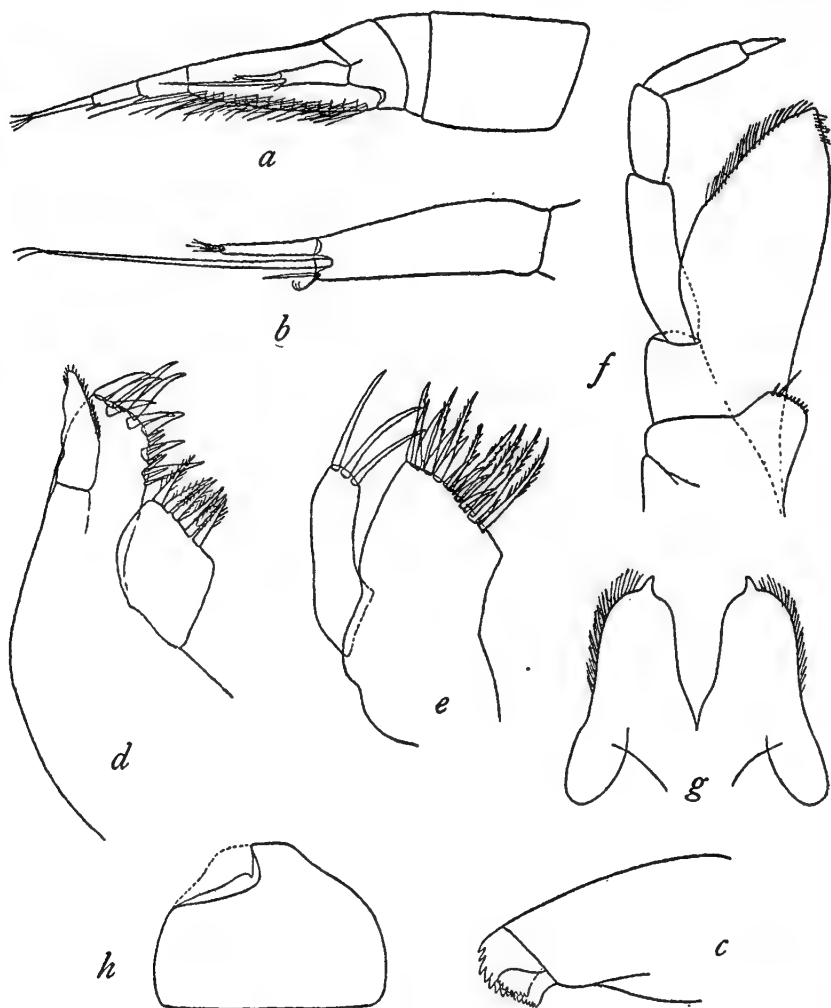


FIGURE 3.—*Andaniella pectinata* (G. O. Sars). *a*, Antenna 1; *b*, accessory flagellum of antenna 1 enlarged; *c*, mandible; *d*, maxilla 1; *e*, maxilla 2; *f*, maxilliped; *g*, lower lip; *h*, telson

The female measures 4 mm. in length, and the male a little less. These specimens constitute the first record of the occurrence of this species on the east coast of America. H. J. Hansen, however, has recorded it from the west coast of Greenland, in about latitude  $68^{\circ}$  N.

Though I have no doubt as to the identity of these specimens, they differ slightly in a few points from the description and figures given by Sars. He says of the first antenna: "Accessory appendage about



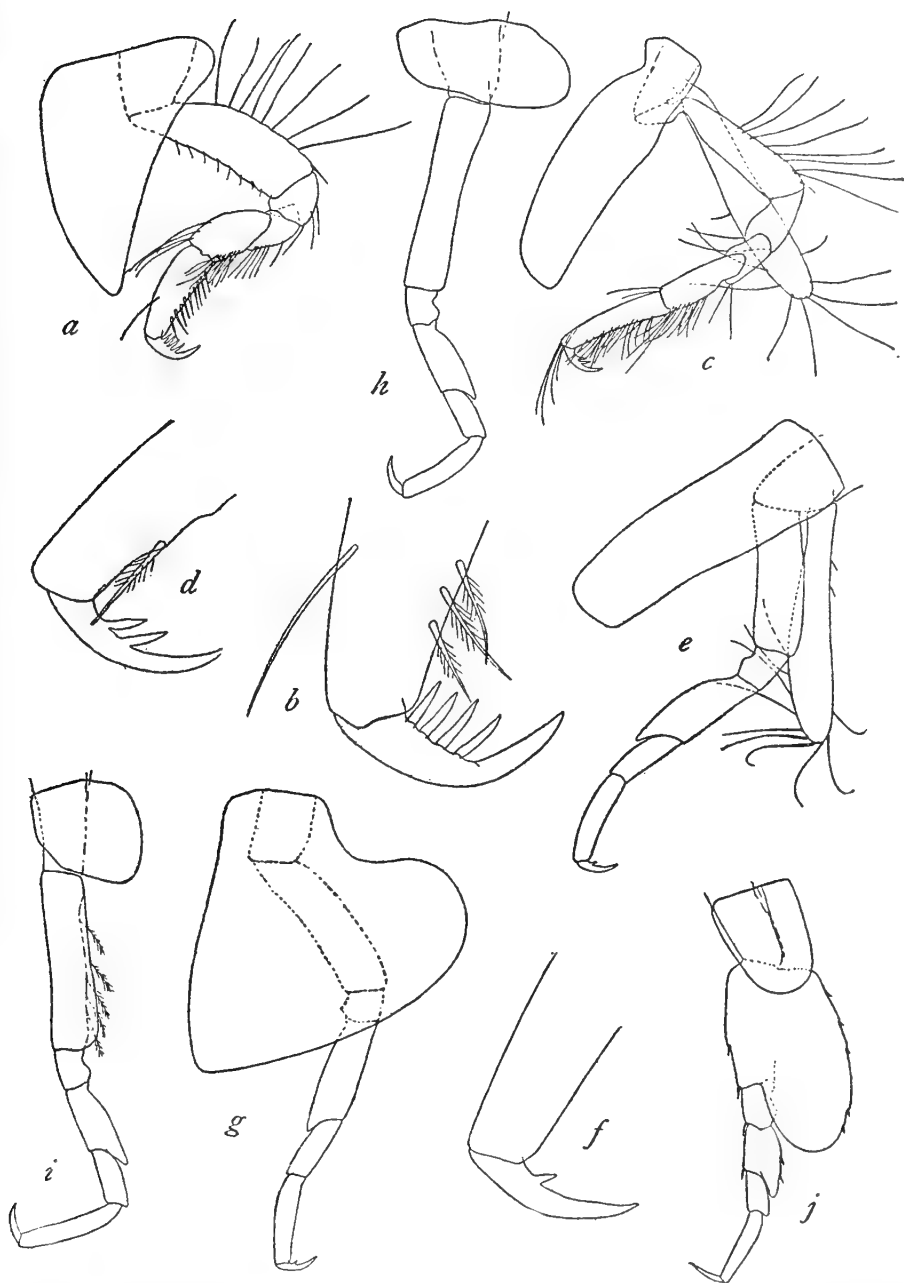


FIGURE 4.—*Andaniella pectinata* (G. O. Sars). a, Gnathopod 1; b, sixth and seventh joints of gnathopod 1 enlarged; c, gnathopod 2; d, sixth and seventh joints of gnathopod 2 enlarged; e, pereopod 1; f, sixth and seventh joints of pereopod 1 enlarged; g, pereopod 2; h, pereopod 3; i, pereopod 4; j, pereopod 5

half the length of the first joint of the flagellum." In the present specimens the accessory appendage is about two-thirds the length of the first joint of the flagellum, and bears a slender second joint, tipped with several short spinules, which is not quite half the length of the first joint. The first joint bears on its lower distal corner a long slender spine, which reaches to the middle of the second joint of the flagellum. The dactyl of the first and second peraeopods bears a stout tooth on the inner margin near the hinge. The inner plates of the maxillipeds are apparently shorter than those figured by Sars, not reaching to the base of the first joint of the palp.

### Family AMPELISCIDAE

#### AMPELISCA MACROCEPHALA Lilljeborg

1852. *Ampelisca macrocephala* LILLJEBORG, Öfv. Vetensk.-Akad. Förh., vol. 9, p. 7.

1891. *Ampelisca macrocephala* G. O. SARS, Crustacea of Norway, vol. 1, p. 172, pl. 60, fig. 1.

Bay of Fundy, United States Fish Commission, 1872, no original number; 1 specimen.

Bay of Fundy, United States Fish Commission, 1872, original number 408; 8 specimens.

Seal Cove, Grand Manan, United States Fish Commission, 1872; 25 specimens.

Grand Manan, between High Duck and Long Island, August 23, 1898, 8 to 9 fathoms, collected by M. J. Rathbun; 3 specimens.

East of Grand Manan, United States Fish Commission, 1872, 60 fathoms, mud; 1 specimen.

Location 55 steamer *Speedwell*, mouth of Bedford Basin, north of Halifax, August 25, 1877, 33 fathoms, mud; 1 specimen.

Location 59 steamer *Speedwell*, Halifax outer harbor,  $\frac{1}{4}$  mile SSW. Rock Head buoy, August 28, 1877, 25 fathoms, gravel; 2 specimens.

Location 72 steamer *Speedwell*, Sandwich Point (Halifax Harbor) W.  $\frac{1}{2}$  N.  $\frac{1}{3}$  mile, September 4, 1877, 18 fathoms, fine sand; 1 specimen.

Location 76 steamer *Speedwell*, Halifax Harbor, halfway between Litchfield and Mars Rocks, September 4, 1877, 18 fathoms, fine sand; 1 specimen.

Location 79 steamer *Speedwell*, off Chebucto Head (entrance of Halifax Harbor), September 5, 1877, 25 fathoms, rocks and millipore; 4 specimens.

Location 83 steamer *Speedwell*, Chebucto Light N.  $\frac{1}{2}$  E. 9 miles, September 5, 1877, 57 fathoms, coarse gravel and stones, bryozoa; 1 specimen.

Location 87 steamer *Speedwell*, mouth Halifax Harbor, Litchfield Rock NE. by E.  $\frac{1}{2}$  E.  $1\frac{1}{2}$  miles, Automatic buoy SE.  $\frac{3}{4}$  S.  $2\frac{1}{4}$

miles, dragging E. to 7 or 8 fathoms on Neverfail Shoal. September 11, 1877, very fine sand, stones, and algae; 3 specimens.

Location 95 steamer *Speedwell*, Halifax Harbor, off York Redoubt and Sandwich Point, September 13, 1877, very fine sand, ooze, and red algae; 6 specimens.

Location 97 steamer *Speedwell*, Halifax Harbor, midway between York Redoubt and McNabs Island Light, September 13, 1877, 16 fathoms; 3 specimens.

Location 98 steamer *Speedwell*, same locality as 97, September 15, 1877, 18 fathoms, mud and fine sand; 1 specimen.

Location 101 steamer *Speedwell*, off Halifax, Sambro Light, W. by N.  $\frac{1}{4}$  N. 9 miles, September 15, 1877, 42 fathoms, fine sand with *Ophioglypha*; 3 specimens.

Location 109 steamer *Speedwell*, Bedford Basin, north of Halifax, September 21, 1877, 37 fathoms; 1 specimen.

Off Halifax, United States Fish Commission, 1877; 2 specimens.

Station 2458 steamer *Albatross*, southeast of Newfoundland,  $46^{\circ} 48' 30''$  N.,  $52^{\circ} 34' 00''$  W., July 2, 1885, 89 fathoms, sand, green mud; 3 specimens.

Station 2461 steamer *Albatross*, south of Newfoundland,  $45^{\circ} 47' 00''$  N.,  $54^{\circ} 13' 30''$  W., July 3, 1885, 59 fathoms, fine sand and black specks; 1 specimen.

Station 2491 steamer *Albatross*, east of Nova Scotia,  $45^{\circ} 24' 30''$  N.,  $58^{\circ} 35' 15''$  W., July 6, 1885, 59 fathoms, white sand; 4 specimens.

Station 2497 steamer *Albatross*, east of Nova Scotia,  $45^{\circ} 04' 00''$  N.,  $59^{\circ} 36' 45''$  W., July 6, 1885, 57 fathoms, yellow sand, broken shells, hard; 24 specimens.

Station 2520 steamer *Albatross*, south of Nova Scotia,  $42^{\circ} 41' 00''$  N.,  $64^{\circ} 55' 30''$  W., July 12, 1885, 62 fathoms, rocky; 1 specimen.

Station 2701 steamer *Albatross*, south of Newfoundland,  $44^{\circ} 56' 00''$  N.,  $55^{\circ} 49' 30''$  W., August 22, 1886, 75 fathoms, gray sand, black specks; 1 specimen.

Station 2703 steamer *Albatross*, east of Nova Scotia,  $44^{\circ} 01' 00''$  N.,  $59^{\circ} 02' 30''$  W., August 23, 1886, 140 fathoms, gray sand and black specks; 5 specimens.

*Ampelisca macrocephala* is of rather common occurrence on the eastern coast of North America from Baffin Land to Jamaica Bay, Long Island.

#### AMPELISCA ESCHRICHTII Kröyer

1842. *Ampelisca eschrichtii* KRÖYER, Naturh. Tidsskr., vol. 4, p. 155.

1891. *Ampelisca eschrichti* G. O. SARS, Crustacea of Norway, vol. 1, p. 174, pl. 61, fig. 1.

Location 55 steamer *Speedwell*, mouth of Bedford Basin, north of Halifax, August 25, 1877, 33 fathoms, mud; 1 specimen.

Location 109 steamer *Speedwell*, Bedford Basin, north of Halifax, September 21, 1877, 37 fathoms; 1 specimen.

Station 2490 steamer *Albatross*, east of Nova Scotia,  $45^{\circ} 27' 30''$  N.,  $58^{\circ} 27' 45''$  W., July 6, 1885, 50 fathoms, gravel and pebbles; 2 specimens.

Station 2497 steamer *Albatross*, east of Nova Scotia,  $45^{\circ} 04' 00''$  N.,  $59^{\circ} 36' 45''$  W., July 6, 1885, 57 fathoms, yellow sand, broken shells, hard; 4 specimens.

Station 2703 steamer *Albatross*, east of Nova Scotia,  $44^{\circ} 01' 00''$  N.,  $59^{\circ} 02' 30''$  W., August 23, 1886, 140 fathoms, gray sand, black specks; 1 specimen.

Upon the eastern coast of North America this species has heretofore been taken in Ungava Bay; Labrador; and the Gulf of St. Lawrence.

#### AMPELISCA AEQUICORNIS Bruzelius

1859. *Ampelisca aequicornis* R. M. BRUZELIUS, Kongl. Svenska Vetensk.-Akad. Handl., new ser. vol. 3, no. 1, p. 82, pl. 4, fig. 15.

1891. *Ampelisca aequicornis* G. O. SARS, Crustacea of Norway, vol. 1, p. 177, pl. 62, fig. 1.

Station 2481 steamer *Albatross*, east of Nova Scotia,  $44^{\circ} 07' 30''$  N.,  $57^{\circ} 16' 45''$  W., July 5, 1885, 116 fathoms, gravel; 1 specimen.

*Ampelisca aequicornis* was taken by the *Ingolf* Expedition off the western coast of Greenland in latitude  $65^{\circ}$  N.; the present record, therefore, is the first directly from the eastern coast of North America, and also marks a southern extension of the range of this species.

#### AMPELISCA LATIPES Stephensen

1925. *Ampelisca latipes* K. STEPHENSEN, Danish *Ingolf*-Expedition, vol. 3, pt. 9. Crust. Malacost. VI. Amphipoda. II. p. 142, fig. 42.

Station 2497 steamer *Albatross*, east of Nova Scotia,  $45^{\circ} 04' 00''$  N.,  $59^{\circ} 36' 45''$  W., July 6, 1885, 57 fathoms, yellow sand, broken shells, hard; 1 specimen.

*Ampelisca latipes* was described by Doctor Stephensen from three specimens taken by the *Ingolf* Expedition off the western coast of Greenland in latitudes  $63^{\circ}$  and  $66^{\circ}$  N. The present record, therefore, extends the range of this species about  $20^{\circ}$  southward, and also marks its initial appearance on the eastern coast of North America.

#### AMPELISCA SPINIPES Boeck

1861. *Ampelisca spinipes* BOECK, Forhandl. Skandinav. Naturforsk., Möde 8, p. 653.

1891. *Ampelisca spinipes* G. O. SARS, Crustacea of Norway, vol. 1, p. 173, pl. 60, fig. 2.

Whiting River, Johnsons Bay, Bay of Fundy,<sup>4</sup> United States Fish Commission, 1872, 2 fathoms; 3 specimens.

<sup>4</sup> Although this locality is in Maine, I have included it in this report, as it is a part of the same faunal area.

*Ampelisca spinipes* is a very abundant species in the vicinity of Woods Hole, Mass., but heretofore it has not been recorded from Nova Scotia.

AMPELISCA AMBLYOPS G. O. Sars

1891. *Ampelisca amblyops* G. O. Sars, Crustacea of Norway, vol. 1, p. 180, pl. 63, fig. 1.

1925. *Ampelisca amblyops* STEPHENSEN, Danish *Ingolf*-Expedition, vol. 3, pt. 9. Crust. Malacost. VI. Amphipoda. II. p. 144, fig. 43.

Station 2481 steamer *Albatross*, east of Nova Scotia,  $44^{\circ} 07' 30''$  N.,  $57^{\circ} 16' 45''$  W., July 5, 1885, 116 fathoms; 1 specimen.

This species was described by Sars from the western coast of Norway. Chevreux recorded it off Cape Finisterre, and Stephensen has recorded it from several localities off the western coast of Greenland. The present record is the first for the eastern coast of North America. Sars gives 8 mm. as the length of the female, and Stephensen's specimens measured between 5 and 7 mm. The present specimen is about 4 mm. in length.

AMPELISCA GIBBA G. O. Sars

1882. *Ampelisca gibba* G. O. Sars, Forhandl. Vidensk.-Selskab. Christiania No. 18, p. 107, pl. 6, fig. 1, 1a.

1891. *Ampelisca gibba* G. O. Sars, Crustacea of Norway, vol. 1, p. 171, pl. 59, fig. 2.

1925. *Ampelisca gibba* STEPHENSEN, Danish *Ingolf*-Expedition, vol. 3, pt. 9. Crust. Malacost. VI. Amphipoda. II. p. 144.

Station 2481 steamer *Albatross*, east of Nova Scotia,  $44^{\circ} 07' 30''$  N.,  $57^{\circ} 16' 45''$  W., July 5, 1885, 116 fathoms; 1 specimen.

Several specimens of this species were taken by the *Ingolf* Expedition off the western coast of Greenland, but it has not heretofore been recorded directly from the waters of the eastern coast of North America. The present specimen measures 7 mm. in length.

? AMPELISCA TYPICA (Bate)

1856. *Tetromatus typicus* BATE, Rep. 25 Meet. Brit. Assoc., p. 58, pl. 17, fig. 8, D 4.

1891. *Ampelisca typica* G. O. Sars, Crustacea of Norway, vol. 1, p. 165, pl. 57.

*Ampelisca typica* has not until now been recorded from the Western Hemisphere. Sars gives 10 mm. for the length of this species; the present specimen, however, measures only about 5 mm. and is presumably quite immature.

BYBLIS GAIMARDII (Kröyer)

1846. *Ampelisca gaimardii* KRÖYER, Voy. Comm. Sci. Nord., Crust., pl. 23, fig. 1a-y.

1891. *Byblis gaimardi* G. O. Sars, Crustacea of Norway, vol. 1, p. 183, pl. 64.

Location 80 steamer *Speedwell*, Chebucto Light N.  $\frac{1}{2}$  E. 9 miles, September 5, 1877, 57 fathoms, mud and pebbles; 1 specimen.

Location 101 steamer *Speedwell*, off Halifax, Devils Island Light N. by W.  $\frac{3}{4}$  W.  $9\frac{1}{2}$  miles, Sambro Light W. by N.  $\frac{1}{4}$  N.  $10\frac{1}{4}$  miles, September 15, 1877, 42 fathoms, shingle; 15 specimens.

Location 109 steamer *Speedwell*, Bedford Basin, north of Halifax, September 21, 1877, 37 fathoms; 1 specimen.

Location 112-118 steamer *Speedwell*, Chebucto Head Light, NW. by W. about 9 miles, September 24, 1877, 52 fathoms, fine sand and mud; 8 specimens.

Location 121 steamer *Speedwell*, Halifax outer harbor, September 27, 1877, 43 fathoms; 2 specimens.

Off Halifax, United States Fish Commission, 1877; 5 specimens.

Station 2458 steamer *Albatross*, southeast of Newfoundland,  $46^{\circ} 48' 30''$  N.,  $52^{\circ} 34' 00''$  W., July 2, 1885, 89 fathoms, sand and green mud; 27 specimens.

Station 2466 steamer *Albatross*, south of Newfoundland,  $45^{\circ} 29' 00''$  N.,  $55^{\circ} 24' 00''$  W., July 3, 1885, 67 fathoms, coral; 1 specimen.

Station 2491 steamer *Albatross*, east of Nova Scotia,  $49^{\circ} 24' 30''$  N.,  $58^{\circ} 35' 15''$  W., July 6, 1885, 59 fathoms; 1 specimen.

Station 2497 steamer *Albatross*, east of Nova Scotia,  $45^{\circ} 04' 00''$  N.,  $59^{\circ} 36' 45''$  W., July 6, 1885, 57 fathoms, yellow sand, broken shells, hard; 29 specimens.

Station 2703 steamer *Albatross*, east of Nova Scotia,  $44^{\circ} 01' 00''$  N.,  $59^{\circ} 02' 30''$  W., August 23, 1886, 140 fathoms, gray sand, and black specks; 5 specimens.

Prof. S. I. Smith in 1872 recorded this species from the Bay of Fundy, and there are also in the United States National Museum collection specimens from Vineyard Sound, Mass., identified by him. On the eastern coast of North America this species has also been reported from Baffin Land; Labrador; and the Gulf of St. Lawrence.

#### HAPLOOPS SETOSA Boeck

1871. *Haploops setosa* BOECK, Forhandl. Vidensk-Selskab. Christiana, 1870, p. 228.

1891. *Haploops setosa* G. O. SARS, Crustacea of Norway, vol. 1, p. 194, pl. 68, fig. 1.

Bay of Fundy, United States Fish Commission, 1872, original number 328; 5 specimens. Original numbers 330 and 549; 8 specimens. No original number; 2 specimens.

Location 47 steamer *Speedwell*, SE.  $\frac{1}{2}$  S. from Cape Sable about 22 miles, August 21, 1877, 59 fathoms, pebbles and sand; 1 specimen.

Location 83 steamer *Speedwell*, Chebucto Light N.  $\frac{1}{2}$  E. 9 miles, September 5, 1877, 57 fathoms, mud and sand; 1 specimen.

Location 106-108 steamer *Speedwell*,  $29\frac{1}{2}$  miles S. from Chebucto Head, September 20, 1877, 110 fathoms, fine sand and mud; 2 specimens.

Station 2466 steamer *Albatross*, south of Newfoundland, 45° 29' 00'' N., 55° 24' 00'' W., July 3, 1885, 67 fathoms, coral; 1 specimen.

Station 2486 steamer *Albatross*, east of Nova Scotia, 44° 26' 00'' N., 57° 11' 15'' W., July 5, 1885, 190 fathoms, coarse sand and gravel; 1 specimen.

On the eastern coast of North America this species has been recorded from the Bay of Fundy and off Georges Bank, and there is in the National Museum collection a specimen taken by the steamer *Fish Hawk* off the mouth of Delaware Bay (39° 48' 30'' N., 70° 54' 00'' W.). Prof. S. J. Holmes has reported it from the *Albatross* station 2055, 40° 32' 00'' N., 68° 17' 00'' W. The specimen from location 83, off Halifax, measures 21 mm.

Doctor Stephensen<sup>5</sup> says: "Some specimens from the Bay of Fundy, determined by S. I. Smith as the present species, probably belong to *H. tubicola*." I have very carefully examined all the specimens in the National Museum identified by S. I. Smith as *H. setosa* and find that they are unquestionably *H. setosa*. I believe that *H. robusta* is but a large form of *H. setosa*, but have hesitated to place it in synonymy for want of authentic specimens of *H. robusta* with which to compare my material. A. M. Norman<sup>6</sup> says:

I have received specimens under this name [*H. setosa*] from S. I. Smith, which were taken in the Bay of Fundy, N. E. America. I am inclined, however, to think that they should be referred to *H. robusta*, G. O. Sars. They are the largest examples I have seen, and in most points, such as the form of the cephalon and of the third segment of the metasome, they agree with Sars's species; but the proportionate lengths of the joints of the peduncles of the two pairs of antennae are different.

#### HAPLOOPS SPINOSA, new species

#### FIGURES 5, 6

Bay of Fundy, United States Fish Commission, 1872, original number 549; 2 specimens.

Whiting River, Johnsons Bay, Bay of Fundy,<sup>7</sup> United States Fish Commission, 1872, 12 fathoms, rocky; 3 specimens.

Off Grand Manan, United States Fish Commission, 1872, 97 to 106 fathoms; 1 specimen.

Location 63-66 steamer *Speedwell*, Bedford Basin, north of Halifax, ¼ across harbor from Navy Island, August 29, 1877, 26 fathoms; 1 specimen.

Location 83 steamer *Speedwell*, Chebucto Light N. ½ E. 9 miles, September 5, 1877, 57 fathoms, mud and sand; 1 specimen.

<sup>5</sup> Danish *Ingolf*-Expedition, vol. 3, pt. 9, Crust. Malacost. VI. Amphipoda. II, p. 154, 1925.

<sup>6</sup> Ann. Mag. Nat. Hist., ser. 7, vol. 5, no. 28, p. 346, 1900.

<sup>7</sup> Although this locality is in Maine, I have included it in this report, as it is a part of the same faunal area.

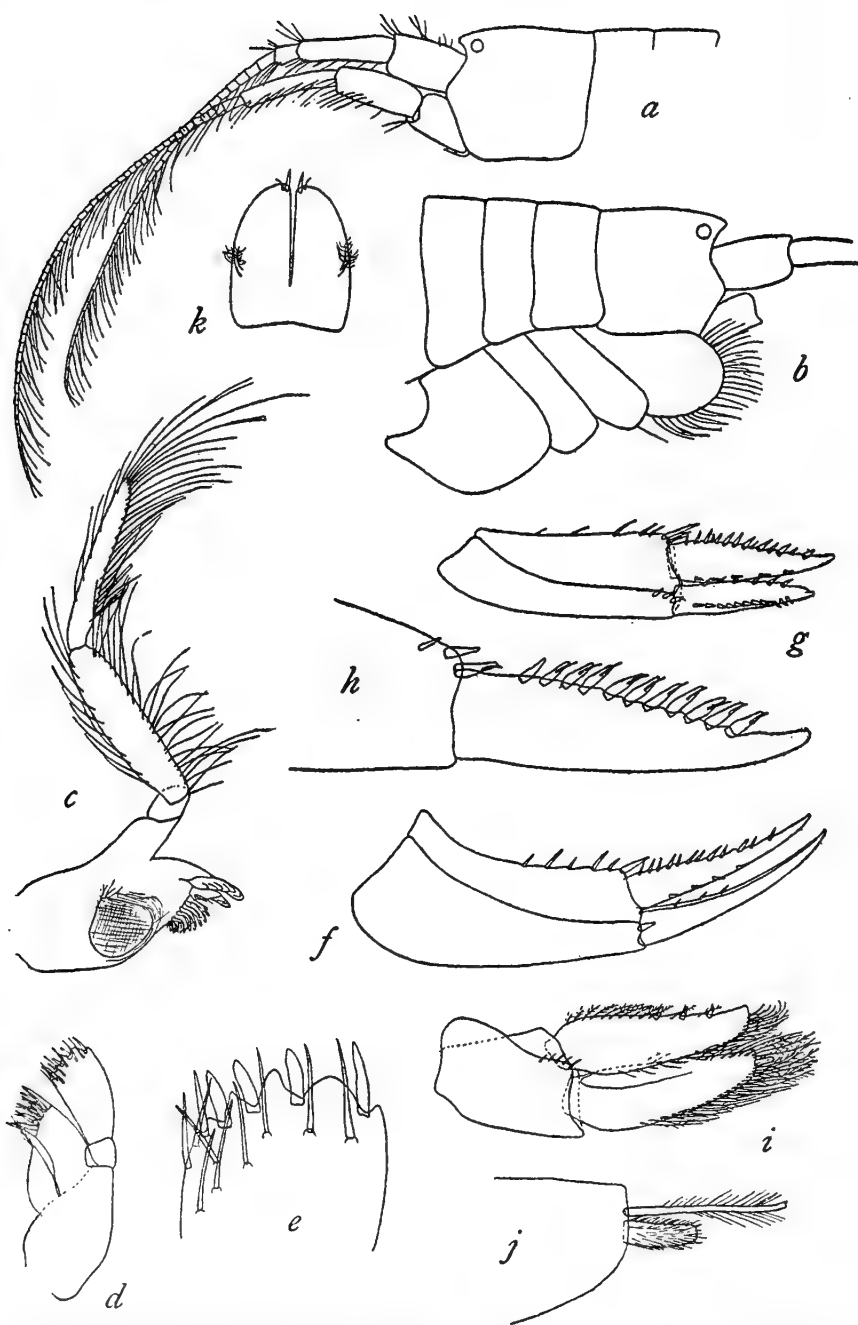


FIGURE 5.—*Haploops spinosa*, new species. Female. *a*, Head and antennae; *b*, head and first four side plates; *c*, mandible; *d*, maxilla 1; *e*, end of palp of maxilla 1 enlarged; *f*, uropod 1; *g*, uropod 2; *h*, outer ramus of uropod 2 enlarged; *i*, uropod 3; *j*, end of outer ramus of uropod 3 enlarged, showing the short blunt spine; *k*, telson



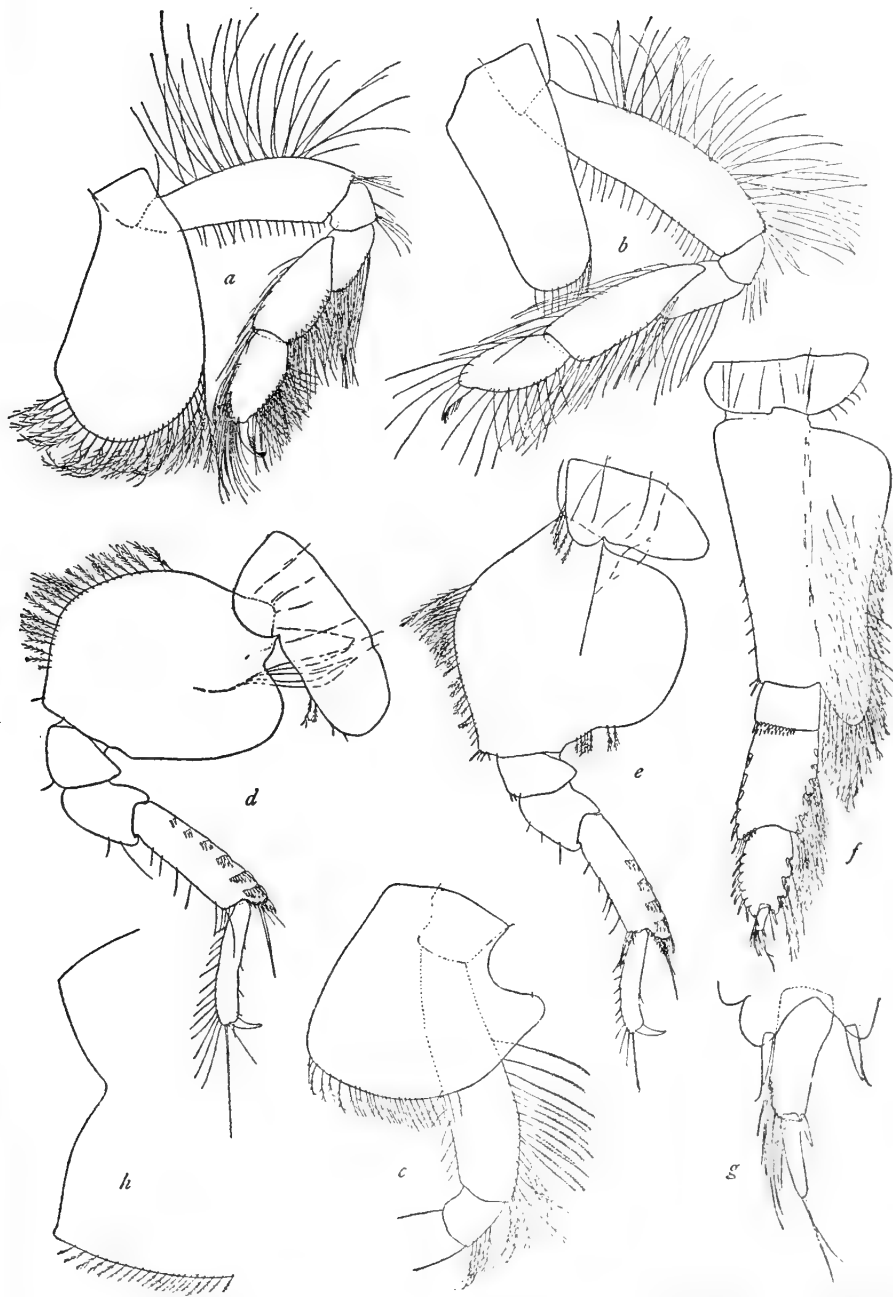


FIGURE 6.—*Haploops spinosa*, new species. Female. a, Gnathopod 1; b, gnathopod 2; c, peraeopod 2 and side plate 4; d, peraeopod 3; e, peraeopod 4; f, peraeopod 5; g, sixth and seventh joints of peraeopod 5 enlarged; h, pleon segment 3

Location 106-108 steamer *Speedwell*, about  $29\frac{3}{4}$  miles S. from Chebucto Head, September 20, 1877, 110 fathoms, fine sand and mud; 3 specimens.

Station 2497 steamer *Albatross*, east of Nova Scotia,  $45^{\circ} 04' 00''$  N.,  $59^{\circ} 36' 45''$  W., July 6, 1885, 57 fathoms, yellow sand, broken shells, hard; 1 specimen.

Station 2499 steamer *Albatross*, southeast of Nova Scotia  $44^{\circ} 46' 30''$  N.,  $59^{\circ} 55' 45''$  W., July 6, 1885, 130 fathoms, black mud; 2 specimens.

Station 2504 steamer *Albatross*, east of Nova Scotia,  $44^{\circ} 23' 00''$  N.,  $61^{\circ} 22' 45''$  W., July 7, 1885, 82 fathoms, black mud and gravel; 1 specimen.

Station 2511 steamer *Albatross*, off Halifax, Nova Scotia,  $44^{\circ} 05' 30''$  N.,  $63^{\circ} 31' 30''$  W., July 11, 1885, 84 fathoms, brown mud; 1 specimen.

Station 2705 steamer *Albatross*, south of Nova Scotia,  $42^{\circ} 47' 00''$  N.,  $61^{\circ} 04' 00''$  W., August 24, 1886, 1,255 fathoms, light brown ooze; 1 specimen.

Lockeport, Nova Scotia, September 21, 1927, taken from haddock stomach by A. W. H. Needler; 1 specimen.

In the National Museum collection are a number of specimens that had been identified as *Haploops tubicola*, but upon close examination several characters become apparent that do not agree with that species and that appear important enough for the founding of a new species.

The relative lengths of the first and second antennae are about as in *H. tubicola*, and the second antenna is a little more than one-third the length of the entire animal. The first joint of the peduncle of the first antenna is much stouter than is usual in the genus *Haploops*. In large specimens there are about 30 joints in the flagellum of the first antenna, and 50 in that of the second. The top of the head is produced only slightly forward, the lateral angles are rounding, and the lower lateral margin is straight. The single pair of eyes is located as in *H. tubicola*. The mouth parts are as figured by Sars for *H. tubicola*<sup>s</sup> except that the palp of the first maxilla is distally broader. The outer plate is armed with 11 serrate spine teeth, and the palp bears 7 marginal spines on distal edge. Side plates 1 to 3 are like those of *H. tubicola*, except that 2 and 3 are not so rounding distally. Side plate 4 is deeper with the lower margin more convex, and the posterior lobe broad and evenly rounded, not acutely pointed as in *H. tubicola*. Peraeopods 1 and 2 as in *H. tubicola*. Peraeopods 3 and 4 as in *H. tubicola*, except that the hind margin of the second joints is much more strongly lobed.

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<sup>s</sup> Crustacea of Norway, vol. 1, pl. 67, 1891.

Peraeopod 5 proportionally much as in *H. tubicola*, but the arrangement of spines and setae is different; both the hind margin and inner surface of the posterior lobe of the second joint are thickly set with long plumose setae, the lower margin of the third joint bears a row of short, stout spines, the fourth joint bears in addition to the stout lateral spines a short row of stout spines on the lower margin, the fifth joint is broader and the lateral spines longer and stouter than in *H. tubicola*, the sixth joint bears a row of long slender spines on lower distal half of front margin, the seventh joint is two-thirds the length of the sixth and bears two long, slender terminal spines. The lower lateral margin of pleon segment 3 slightly convex, the lower angle very little produced, and the lower margin slightly convex and fringed with plumose setae. Uropod 2 projecting backward slightly beyond 1, but much less than 3. The peduncle of uropod 1 is a little longer than the rami, the outer of which is slightly longer than the inner. The relative proportion of these rami is somewhat variable, in some specimens the inner ramus is very nearly as long as the outer, while in others it is decidedly shorter. The outer edge of the peduncle of uropod 1 is without spines except for a single terminal one, but the inner edge bears spines on the distal half; the outer ramus bears three spines on the proximal half of the inner edge, but none on the outer edge; the inner ramus bears many spines on inner edge and four on proximal half of outer edge. In uropod 2 the outer ramus is shorter than the inner and bears on the outer edge a row of closely set stout spines, each of which bears a setule near the apex, the inner edge bears a more sparsely set row of spines; in the inner ramus the arrangement of spines is reversed, the inner edge bearing the closely set row and the outer the sparsely set row. Uropod 3 has the rami equal in length, foliaceous, and very bluntly rounded terminally; the outer ramus bears a closely set row of plumose setae on the outer and inner edges and the distal extremity, and this extremity also bears a short, stout, blunt spine, which is clothed with short setules; the inner ramus bears a closely set row of plumose setae on the distal half of the inner margin and the distal extremity, the inner margin bears three short stout spines on the distal half and a row of short plumose setae on proximal half. The telson is much like that of *H. tubicola* except that there are two plumose setules near the center of the lateral margins.

Length of the largest specimen is about 19 mm.

*Type*.—U.S.N.M. No. 62831.

*Locality*.—Location 106-8, steamer *Speedwell*, 44° 01' N., 63° 20' W., about 29¾ miles S. from Chebucto Head, September 20, 1877, 110 fathoms, fine sand and mud.

The specimens that I have had the opportunity of examining are apparently all females, and the dorsal process of the fourth pleon segment is just as shown by Sars for the female of *H. tubicola*. The specific name *spinosa* is given in reference to the rows of strong spines on the rami of the second uropods. Stebbing<sup>9</sup> figures the second uropod of *H. laevis* as having a row of spines on the outer ramus, but those of the inner ramus are not nearly so numerous or conspicuous as in the present species.

HAPLOOPS SIMILIS Stephensen

1925. *Haploops similis* K. STEPHENSEN, Danish *Ingolf*-Expedition, vol. 3, pt. 9. Crust. Malacost. VI. Amphipoda. II. p. 156, fig. 46.

Station 2491 steamer *Albatross*, east of Nova Scotia, 45° 24' 30'' N., 58° 35' 15'' W., July 6, 1885, 59 fathoms, white sand; 2 specimens.

Station 2497 steamer *Albatross*, east of Nova Scotia, 45° 04' 00'' N., 59° 36' 45'' W., July 6, 1885, 57 fathoms, yellow sand, broken shells, hard; 3 specimens.

Station 2499 steamer *Albatross*, southeast of Nova Scotia, 44° 46' 30'' N., 59° 55' 45'' W., July 6, 1885, 130 fathoms, black mud; 4 specimens.

This species was described by Doctor Stephensen from a single specimen taken off the western coast of Greenland by the *Ingolf* Expedition. His specimen measured 4.5 mm., while the present ones are from 3 to 4 mm.; they appear, however, to agree very well with the figures he has given.

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<sup>9</sup> Bijdragen tot de Dierkunde, vol. 17, pl. 3, uropod 2, 1894.



# ANODONTITES: A GENUS OF SOUTH AND CENTRAL AMERICAN AND MEXICAN PEARLY FRESH-WATER MUSSELS

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By WILLIAM B. MARSHALL

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The honor of describing the second South American naiad of any kind fell to Bruguière (1792*a*, p. 107) when he described *Unio granosa* (now *Diplodon granosus*).<sup>1</sup> Certainly the credit of describing the first genus of South American mussels fell to him in the same year, when he described the genus *Anodontites* (1792*b*, p. 131) and the third known South American mussel, *A. crispata*, in the same paper.

From the very start both this genus and species had a hard time of it, and were knocked around from pillar to post, and it was not until 1909 that they really began to get into the position to which they were entitled. Many authors, in dealing with them, have made serious errors. It is the object of this paper to correct as far as possible all errors that have been made regarding *Anodontites* and the species *crispata*, and to give a complete account of the early history of the genus and species, touching here and there upon the history of various other genera, such as *Unio* and *Anodonta*. These two genera hold such an important place in the history of the naiades that in order to understand the group it is necessary to know something of their early history. The data given in this paper, it is believed, will make the beginning of a study of the South American mussels easy to any student who wishes to enter upon it.

The first great forward stride in the study of the pearly fresh-water mussels was in 1788, when the genus *Unio* was described to include all those pearly, fresh-water mussels having cardinal teeth or both cardinal and lateral teeth, a character that segregated them from the marine mussels. The authorship of the genus is generally credited to Retzius (1788), but some credit it to his student Philipppson (1788). The following note by Simpson (1900, p. 679) explains this matter completely:

This genus was described in a thesis by Laurentius Münster Philipppson under his master, Retzius, in the University of Lund, Sweden, and it is often credited

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<sup>1</sup> So far as known the first mention in literature of any South American pearly fresh-water mussel was by Klein (1753), who described and figured *Triquetra subviridis* of Guiana and Brazil. He being a nonbinomial author, his name had to be rejected in favor of *Mya syrmatophora* (now called *Pisodon syrmatophora*) Meuschen (1781).

to the former. I am informed by Professor Joh. Chr. Moberg, of Lund, that by a former law or custom of the university the professor was considered the author of all papers which a student under him defended. According to this, Retzius must be credited with the genus. This law was repealed in Lund in 1852.

Retzius seems to have been legislated into authorship instead of writing himself into it.

According to Ortmann (1911), American species of "Unio" belong to the genus *Elliptio*. The genus *Unio* is reserved for *Unio pictorum*, etc.

Another note by Simpson (1900, p. 674) says that "Retzius' first species in *Unio*, the type of a section without laterals, is the *U. margaritifer*, but in 1792 Bruguière in Choix de Memoires, I, p. 106, fully and carefully redefined the genus *Unio*, restricting it to species with cardinal and lateral teeth." Up to this time, 1792, nothing had been done toward classifying the naiades having neither cardinal nor lateral teeth. Bruguière (1792*b*, p. 131) described the genus *Anodontites*, founded on the new species *crispata*. His description and figure of this genus and species lie at the root of the later study of the edentulous naiades, especially those from South America and West Africa. As his description and figure are inaccessible to many students, a translation and a copy of his figures are given herein.

Bruguière took what we call the front end of the shell to be the back end, and vice versa, the height to be the length, the length to be the width. In the translation the following substitutions have been made in order to have Bruguière's terms<sup>2</sup> conform to terms now in use:

Anterior substituted for posterior.

Posterior substituted for anterior.

Height substituted for length.

Length substituted for breadth.

Beak substituted for summit.

Concentric striae substituted for transverse striae.

Radiating striae substituted for longitudinal striae.

Muscle scar substituted for muscular attachment.

The Latin diagnosis is given verbatim.

#### ON A NEW SHELL OF THE GENUS ANODONTITES<sup>3</sup>

BY J. G. BRUGUIÈRE

In the Linnaean system the genus of the Moule (Mussel. *Mytilus*) comprises shells so essentially different that among 20 species treated by that author there are really only 11 that belong to it; the others go into the genus of the Huitre (Oyster. *Ostrea*), into those of the Hyronde (*Avicula*, etc.) or of the *Cardita*, and 2 of them belong to the genus *Anodontite* (*Anodontites*), of which I am about to give the description.

<sup>2</sup> Marshall (1930*b*, p. 41) published notes on Bruguière's use of terms.

<sup>3</sup> From Journal d'Histoire Naturelle, vol. 1, pp. 131-136, pl. 8, figs. 6, 7, 1792.

Besides these two shells of which Linnaeus has spoken, and which he has designated in his works under the names of *Mytilus cygneus* (*Anodonta cygnea* L.) and *Mytilus anatinus* (*Anodonta anatina* L.), I know seven other species, not counting the one of which I shall speak, most of which have not yet been described.

The genus *Anodontites* takes its name from the hinge of the shells that inclose it, which is plain and without teeth, and consequently very different from the hinge of the other regular bivalve shells. It differs from the shell of the *Moule* (Mussel. *Mytilus*), not only by this circumstance, which is applicable to only a few of the species of this latter genus, but also by the form of the shell, which is higher than long in the *Moule* (Mussel. *Mytilus*), and fixed by a byssus, while the shell of *Anodontites* is longer than high and always free. Above all they differ by the number of muscle scars, which never exceed two in the *Moule* (Mussel. *Mytilus*), but always number three in *Anodontites*, without counting some light scars in the cavity of the beaks, which may furnish new attachments to the animal of some species, but which are not visible in others.

This last character merits consideration. It is common with the genus *Mulete* (*Unio*) but is never found in any marine shell, and may thus serve to prove the fluviatile origin of the shells in which it occurs. One should not, however, conclude that all fluviatile bivalves have three muscle scars, for there is also a genus undescribed and equally distinct from the genera *Mulete* (*Unio*) and *Anodontites*, of which the shells have only two scars and which live in fresh water only.

If the best method of conchology should be that which bears equally upon animal and shell, one may conclude that until the knowledge of the worms<sup>4</sup> is sufficiently advanced to undertake this work with success, it is at least necessary to consider in shells those parts that offer the most relations with the structure of the animals, or at least with some notable part of their organization, among which there is no doubt that the muscle scars deserve first rank. If Linnaeus had had regard for this essential part of the shell he would not have introduced in the genera of the *Moule* (Mussel. *Mytilus*), *Huitre* (Oyster. *Ostrea*) and *Hyrondes* (*Avicula*, etc.), which have only one attachment in each valve, the *Cardita*, which has two, and *Anodontites*, which has three. Furthermore, he would have distinguished the *Anomias* from the *Terebratulas* by this single character, independent of those furnished by the regularity or irregularity of the shell and by the hinge.

ANODONTITE	ANODONTITES
<i>Characters of the genus:</i>	<i>Charact. generis:</i>
<i>Shell</i> , bivalve, longitudinal, regular, free.	<i>Testa</i> , <i>Bivalvis</i> , <i>transversa</i> , <i>regularis</i> , <i>libera</i> .
<i>Valves</i> , equal, inequilateral, closing throughout, nacreous within.	<i>Valvulae</i> , <i>aequales</i> , <i>inaequilaterae</i> , <i>undique clausae</i> , <i>intus margaritaceae</i> .
<i>Muscle scars</i> , three in each valve; one near the posterior border, two unequal, united or distant near the anterior border.	<i>Impressiones musculares</i> , <i>tres in unaquaque valvula</i> ; <i>una prope marginem anteriorem</i> , <i>duae inaequales unitae aut distantes juxta marginem posteriorem</i> .
<i>Beaks</i> , always eroded.	<i>Apices</i> , <i>semper erosi</i> .
<i>Hinge</i> , edentulous, not grooved.	<i>Cardo</i> , <i>edentulus nec canaliculatus</i> .
<i>Ligament</i> , exterior, slightly convex.	<i>Ligamentum</i> , <i>exterior parum prominens</i> .

<sup>4</sup>Mollusks formerly were classed with worms.—W. B. M.

ANODONTITE *crepue*

*Anodontite*, shell oval, marked with radiating striae and with concentric striae, which are elevated, rippled.

ANODONTITES *crispata*

*Anodontites*, *testa ovali, striis longitudinalibus transversisque elevato-crispatis cancellata.*

*Description:*

*Height*, 10 lignes; <sup>5</sup> *length*, 1 ponce 7 lignes; <sup>5</sup> *diameter*, 6½ lignes.<sup>5</sup>

*Form*, broad at the rear end, marked with a slight angle terminating at the margin; rounded at the front end.

*Valves*, thin, furnished on their surfaces with distant radiating grooves, less marked near the margins and on the posterior area, crossed by concentric striae which are more crowded, elevated, and waving and lightly lamellose near the borders.

*Muscle scars*, three in each valve; that of the posterior end large and superficial, the two of anterior end unequal, rather deep.

*Beaks*, eroded, rather prominent, situated anteriorly at the first quarter of the length of the shell.

*Ligament*, yellowish, extending from the beaks to the posterior third of the shell.

*Color*, brownish, corneous on the decorticated portion of the beaks, nacre silvery and opaque near the margins.

This shell inhabits the rivers of Guiana whence it was sent to me by M. le Blond.

EXPLANATION OF FIGURES 6<sup>6</sup> AND 7<sup>7</sup> OF PLATE 8

6. *Anodontites crispata*. Valves opened, natural size showing muscle scars, of which the lower two are united.

7. The same shell closed, showing its convexity and its ligament.

It may be noted that there is nothing in Bruguière's description to differentiate between the genus *Anodontites* as we now understand it and other edentulous naiades, such as *Anodonta* Lamarck, *Leila* Gray, *Spatha* Lea, *Mutela* Scopoli, and others. Except for the species *crispata*, described and figured along with the description of the genus, and the locality from which that species came, the name *Anodontites* might well stand for the genus *Anodonta*. Bruguière did not notice the peculiar triangular shape of the sinulus and apparently saw no generic difference between his *Anodontites crispata* and the common European edentulous naiades *Anodonta cygnea* Linnaeus (*Mytilus cygneus* L.), and *A. anatina* Linnaeus (*M. anatina* L.), both of which he mentioned as belonging in his new genus.

It seems remarkable that Bruguière founded his genus on a shell sent to him from a distance of 4,500 or more miles when, right in his own neighborhood, he had available *Anodonta cygnea* and others that he thought belonged in his new genus. Had he used one of

<sup>5</sup> Professor Lamy, of the Paris Museum, has given me the following equivalents for these measurements:

Height, 10 lignes	= 22. 25 mm.
Length, 1 ponce 7 lignes	= 42. 86 mm.
Diameter, 6½ lignes	= 14. 66 mm.

<sup>6</sup> Pl. 1, fig. 3, of this paper.

<sup>7</sup> Pl. 1, fig. 2, of this paper.



the European species for type, all *Anodontas* would now be *Anodontites*. The reason he selected the South American shell may have been that coming from such a distance it excited a peculiar interest, which the home species had failed to arouse because of his familiarity with them, and also that he saw that the South American shell was of a species that had never before been found and its sculpture of a delicacy and beauty that until then were unknown in fresh-water mussels and that rarely have been equaled in species discovered since. Marshall (1930a, p. 128) published a brief note on this style of sculpture in *Anodontites* and other genera, remarking that so far as known to him it is found only in naiades from the region which includes the northern edge of South America, Honduras, and Nicaragua.

Lamarck (1799, p. 87) described the genus *Anodonta* as follows: "Anodonte. *Anodonta*. Shell transverse having three muscular impressions, hinge simple, without any tooth. *Mytilus cygneus* L." There is nothing here to differentiate *Anodonta* from *Anodontites* except the citation of *Mytilus cygneus* Linnaeus as an example of the new genus. It seems probable that Lamarck intended *Anodonta* to replace *Anodontites*, though it is impossible to think of any just grounds for the substitution. It is to be noticed that Lamarck's description says nothing about the sinus.

Lamarck (1819, p. 83) gave a much longer description of *Anodonta* than he gave originally (1799, p. 87). His description and remarks indicate that he, too, considered the anterior end the posterior. He says: "But what especially distinguishes them (*Anodonta*) is that here the cardinal tooth and the lateral tooth of the Mulettes (*Unio*) have entirely disappeared and that the hinge offers only a simple border adnate or applied under the nymphe which is terminated anteriorly by a truncation or sinus. It is in this sinus or in the little space which the truncation leaves that the anterior extremity of the ligament buries itself." The sinus spoken of here is what we now call the sinus or ligamental scar in each valve at the posterior (not anterior) end of the ligament.

While, according to our idea, Bruguière and Lamarck both had their shells "wrong end to," yet Lamarck had the correct idea of the posterior end of the animal, which occupies the shell. He says (1819, p. 84): "The animal of *Anodonta* has two short tubiform apertures, which it forms with the posterior extremity of its mantle and which are furnished with small tentacular filaments." Doubtless Lamarck, great naturalist though he was, would have enjoyed the joke he perpetrated on himself had he noticed the absurdity of having the rear end of the animal at the "front" end of its shell. It may be that other naturalists of his day had not sufficient knowledge of shell and animal to note the absurdity. At least there seems

to have been no notice taken of it. It may have been noticed and may have led to a more correct use of "anterior" and "posterior" in referring to the naiades. Rafinesque (1819) in mention of *Unio* used them as Bruguière and Lamarck did in *Anodontites* and *Anodonta*, but the next year (1820) he used them correctly in one of his papers which have aroused so much controversy over the naiades. This is shown by his descriptions; also directly on page 299 (1820) thus: "*Metaptera* \* \* \* means posterior wing. At first (viz, 1819, p. 426) I adopted *Proptera*, which was an error, for it means anterior wing."

Further along in his observations on *Anodonta* cited above Lamarck touches on the embryology of these mollusks. He says: "It is hermaphroditic and apparently viviparous; for the eggs pass into the gills, where one finds the young with their shell all formed."

Swainson (1840, p. 287) offered a generic name *Patularia*, but without description. On page 381 he cites *Anodonta ovata* Swainson and *A. rotundata* Swainson. These he described and figured in his *Exotic Conchology* (1821-22, pls. 36, 37), but gave no locality. Hanley, who edited the second edition of the *Exotic Conchology* (1841), says there that *ovata* is a synonym of Lamarck's *trapezialis*, while Simpson (1900, p. 922) doubtfully refers it to *Glabaris trautwinianus* Lea. Hanley let Swainson's *rotundata* stand as a good species, but Simpson (1900, p. 638) doubtfully thought it the same as *Anodonta woodiana* Lea. Because of the doubt surrounding it the name *Patularia* may well be disregarded, and in any event the specimens cited by Swainson probably are not *Anodontites*. His *ovata* seems to be a *Leila*, while his *rotundata* is *Anodonta woodiana* Lea, as supposed by Simpson.

Gray (1847, p. 197) used the name *Anodonta esula*. On page 206 of the same paper he says in errata, to "No. 691 add *Glabaris*"—probably meaning this as a new generic name for the *A. esula*, but there was no description.

*Anodonta esula* Lamarck is now thought to be a variation of *A. trapezialis* Lamarck, and as the latter belongs in the genus *Leila* Gray, 1840, according to Frierson (1922, p. 7), the name *Glabaris* becomes a synonym of *Leila*.

Unfortunately Ihering (1893) and Simpson (1900, p. 916) used *Glabaris* for *Anodontites*, and the former was in general use until 1909. Thiele (1909) revived the name *Anodontites* Bruguière, and Ortmann (1911, p. 88) confirmed Thiele's conclusions. Simpson (1914, p. 1403) used the name *Anodontites*. Marshall (1930a, p. 128) shows that Ortmann (1921, pls. 40, 41) figured for *Anodontites crispata* Bruguière a species that the next year was described by Marshall (1922, p. 7) as *Anodontites colombiensis*.

It is important that Ortmann's error be corrected, as *crispata* and *colombiensis* belong in different sections of *Anodontites*, and a mis-

understanding of the true *crispata* will make the classification of the species of the genus invalid.

It will be well to direct attention here to a footnote by Ortmann (1921, p. 539), as follows: "Bruguère uses *Anodontites* as *femini generis*, and this should not be changed." Most authors have used the name as masculine.

Until recently the division of the edentulous naiades into genera depended solely on conchological characters. Upon comparing the various descriptions one finds that the description of one genus would often fit one or more others. Casual mention was made in some species of the ligamental scar, but it remained for von Martens (1900, p. 523) to point out the real importance of the sinulus, and his remarks are especially valuable in regard to South American naiades. Referring to Fischer and Crosse's classification of *Anodonta* (1894), he says: "They do not mention the shape of the sinulus, a notch in the hinge line, at the hinder end of the ligament. This, I think, is an important character, the sinulus being deep, triangular, with a sharp point, and vertically as deep as broad, in the South American species, and, on the contrary, shallow and rounded in the North American and European forms."

Practically all the South American naiades with edentulous hinge, such as *Anodontites* and *Leila*, or with a hinge bearing peculiar cardinal teeth and lacking lateral teeth, such as *Monocondylaea*, *Fossula*, *Diplodontites*, have the sinulus large and nearly equilaterally triangular. In some of the elongate forms, such as *Mycetopoda* and *Mycetopodella*, the triangular form is not so distinct, probably being modified by the great length in comparison to height found in these genera.

Turning now to the species *crispata* we find that neither Simpson nor Ortmann understood it. Ortmann (1921) dealt with incorrectly identified material from a locality far removed from the type locality. Both Simpson and Ortmann seem to have been misled by Bruguère's specific name *crispata*. It evidently was used in the sense of crimped, while Simpson, in dealing with *A. reticulata* Sowerby, and Ortmann with *A. colombiensis* Marshall, interpreted it as meaning crinkled. "Crimped" and "crinkled," although both translate *crispata*, are very different, the former conveying the idea of regularity in the wrinkling, and the latter the idea of being wrinkled or rump'ed with little regard to uniformity. "Crimped" nicely describes the sculpture of *A. crispata*, while "crinkled" describes that of the other two species.

The Carnegie Museum kindly sent me for examination the specimens identified as *A. crispata* Bruguère by Ortmann and figured by him (1921) on Plate 41, Figures 2a, 2b, and generously donated two specimens from the same lot as the figured specimen. The locality

is Rio de la Paila, Paila, Republic of Colombia. Comparison with the type of *A. colombiensis* Marshall proves beyond doubt that Ortmann's specimens belong to that species and not to *A. crispata* Bruguère. Figures on Plate 2 of the present paper show that *A. crispata* Ortmann is exactly like *A. colombiensis* in form and sculpture and radically different from the true *A. crispata* Bruguère.

Ortmann gave as type locality "South America." This was not explicit enough, as Bruguère recorded the type locality as "Rivières de la Guyanne."

The localities cited by Ortmann, except Cayenne (Lea), are to be rejected. They were Amazon River (Sowerby, *reticulatus*) and Rio de la Paila, United States of Colombia—a tributary of the upper Rio Cauca of the Rio Magdalena drainage. Simpson's statement that *A. crispata* is "widely distributed in tropical South America" is to be rejected also, for at the present time *crispata* is known only from Guiana (and in that region probably only from the vicinity of Cayenne in French Guiana).

From a nomenclatorial standpoint Ortmann made a valuable suggestion when he pointed out in that paper that as *crispata* is the type of the genus *Anodontites* it must necessarily be the type of the section *Anodontites* s. s. Simpson (1914, p. 1403) grouped a number of species in a section *Anodontites* s. s., the first group under the sectional description being the group of *A. patagonicus* and the first species in the group being also *patagonicus*. On page 1414 *crispatus* is the first species in the group of *A. crispatus*. Although both these groups and several others were placed in the section *Anodontites* s. s., the fact that *patagonicus* heads the list makes it appear that Simpson intended that species to rank as the type of the section.

Ortmann (1921, pp. 587, 588) attempts to correct Simpson's (1914) division of *Anodontites* in three sections, viz, *Anodontites* s. s., *Styganodon* von Martens (1900), *Virgula* Simpson (1900), but because of his erroneous identification of *colombiensis* Marshall with *crispata* Bruguère the attempt resulted in serious errors. Ortmann says (1921, p. 588):

*Styganodon* is well characterized by the epidermis; but unfortunately the type of the genus (*Anodontites crispata*) undoubtedly belongs to *Styganodon*, having an epidermis (thick, dark, rough, somber colored) which represents an extreme development of the *Styganodon* structure; in other characters also *A. crispata* is closely allied to *A. tenebricosa*, the type of *Styganodon*.

It is clear that, on the one hand, *Anodontites* (*sensu strictiore*) must be used for *crispata* and, on the other hand, that *Styganodon* is a synonym of this, the type of the latter being closely related to *crispata*. This necessitates a rearrangement of the sections and a revision of their nomenclature.

The well-known *Anodontites tenebricosa* Lea is the type of *Styganodon*. Its features are so different from those of *A. crispata* that

the two can not possibly be members of the same section. Therefore the section *Styganodon* must be accepted as valid and *A. crispata* must be placed as the type of *Anodontites* s. s. At present it is believed to be the only species thoroughly entitled to a place in that section but showing relationship to others, which might well be placed in a subsection, or perhaps better in a new section to include species such as *puberula* Gould, *tortilis* Lea, *lutcola* Lea, *pittieri* Marshall, *aroana* H. B. Baker. These species have a type of periostracum that has relationship to that of *A. crispata* and to a lesser extent to that of *A. colombiensis*, but very little similarity to that of *A. tenebricosa*.

Simpson (1914, p. 1403) accepted the generic name *Anodontites* instead of *Glabaris*, which he had used in 1900. In 1914 his treatment of the synonymy of *A. crispata* was as follows (rejecting such references as were based upon simple citations of names unaccompanied by figures or descriptions):

#### ANODONTITES CRISPATUS Bruguière

*Anodontites crispatus* Bruguière, Jl. d'Hist. Nat. I, 1792, p. 131. [To this he should have added pl. 8, figs. 6, 7.]

*Anodonta crispata* Lamarck An. sans Vert. VI, 1819, p. 86.

? *Anodonta crispa* Lamarck Enc. Meth. II, 1827, p. 147, pl. cciii, fig. 3.

*Anodonta puberula* Gould U. S. Expl. Ex. xii, 1852, p. 434, figs. 548, 548a, 548b.

*Anodon reticulatus* Sowerby Conch. Icon. xvii, 1867, pl. x, fig. 27.

His treatment in 1900 was the same as the foregoing except that *Glabaris* was used, and on page 919 there was a footnote to *Anodonta crispata* Lamarck, saying: "Lamarck refers to Encyclopédie Méthodique pl. cciii, figs. 3, 3a, 3b," and a footnote to *Anodonta puberula* Gould, saying: "According to Lea's note on the margin of this description the species=*crispata*. I think he is right."

Lamarck's (1819, p. 86) description of *Anodonta crispata* was as follows:

#### 7. Anodonte crépue. *Anodonta crispata*.

*A. testâ oblongo-ovata, subdepressâ, tenui, medio coarctatâ; costellis longitudinalibus confertis, planulatis, transversim sulcato-crispis.*

Encyclop. pl. 203. f. 3. a, b.

Habite . . . . dans les rivières des régions australes? Du voyage de Baudin. Mus. n°. Mon cabinet. Son épiderme offre sur le milieu, et presque sur le côté postérieur, des côtes rayonnantes, aplaties, traversées par des sillons arqués, fréquens et ondes. Cet épiderme est d'un brun-fauve. Largeur, 51 millimètres.

There is nothing in this description to show that Bruguière and not Lamarck was the author of *crispata* except the reference to the figures in the Encyclopédie Méthodique. Those figures are a rather poor reproduction of the figures published by Bruguière with his original description of *crispata* in 1792. *A. crispa* Lamarck is a mis-

print for *A. crispata*. The dates and authors of early volumes of the Encyclopédie are confused. Bruguière died before he could prepare the explanation of the plates of the part prepared by him, and this work later was done by Bory St. Vincent. Sherborn and Woodward<sup>8</sup> explain the dates of this publication.

So far as *Anodontites crispata* is concerned the Encyclopédie is of no importance except for Lamarck's reference in his description to Bruguière's figures 3a and 3b, and future students of this species may well dismiss it from consideration.

As shown by Simpson's synonymy of *A. crispata*, given above, the collection of the United States National Museum contains a number of specimens arranged under that name. Only one of them is really *crispata*. It is No. 86402 from Cayenne, French Guiana, and was received by Isaac Lea from Baron Ferussac. Although sure that this specimen was *A. crispata*, to make assurance doubly sure the aid of the Paris Museum was sought in an effort to locate Bruguière's type. The location of the type is unknown, but Professor Lamy sent notes that are of special interest. He says:

The only specimen of *Anodonta crispata*, which is found mentioned in a catalogue of our collections made towards 1835, is the individual described by Lamarck in the Hist. des Anim. S. Vert., vol. VI, first part, page 86, figure 3a-b of plate 203<sup>9</sup> of the Encyclopédie Méthodique. Consequently, from that period (1835) there was no trace here of the type of Bruguière. That specimen of Lamarck still exists in our collections, accompanied by a label written in Lamarck's hand, "Anodonte crepue, *A. crispata*," and by another behind it with this statement: "Cayenne? from the Voyage of Capt. Baudin." It can not therefore refer to the type of Bruguière dating from 1792, as the Baudin Expedition was in 1801.

In view of the relations which existed between Bruguière and Lamarck, it is possible that the latter, who certainly must have seen the type of the former, borrowed the name *crispata* from him; but that is not to be found stated anywhere.

Later Professor Lamy had photographs on an enlarged scale made at my request to show the sculpture and interior of that specimen of *A. crispata*, and they prove conclusively that our specimen (No. 86402) is that species. So far as known to me our specimen and the one in the Paris Museum are the only two still in existence that have received careful study.

Because of the fact that *A. crispata* lies at the root of the study of South American naiades; the injustice and errors that have attended its stormy career, and the ease of offering more accurate

<sup>8</sup> On the dates of the Encyclopédie Méthodique (Zoology). Proc. Zool. Soc. London, 1893. pp. 582-584; 1899, p. 595.

<sup>9</sup> Lamarck referred to pl. 203, figs 3a-b, but they are copies of Bruguière's original figures and, consequently, could not have been made from the specimen now in the Paris Museum.—W. B. M.

illustrations than were possible in Bruguière's time, the species deserves a fuller description than has ever been given it. The following is therefore offered:

ANODONTITES CRISPATA Bruguière

Shell elongate-ovate, rather compressed and thin. Anterior end narrower, rather abruptly rounded, obliquely fading into the ventral margin. Posterior end broader, obliquely truncate above to a rib on the posterior dorsal area, then rounding into the ventral margin without angle. A shallow depression across the disk from beak to near the middle of the ventral margin. Ventral margin nearly straight, very faintly incurved at its middle portion and slightly gaping in that region. Posterior dorsal ridge rounded; above it a rather strong rib running across the dorsal area from the beak to the posterior margin. Sculpture of many festoons arranged to form a beautiful sculpture, which is distinct both radially and concentrically. Radiating from the beaks to the margins are many apparent sulci, but they are formed by the festoons being arranged on the background in radiating units, the space between each adjoining unit seeming to be cut into the surface. The sculpture is less pronounced and somewhat confused on the anterior and posterior areas. Color nearly uniform light chestnut. Interior not very iridescent, bluish white, the nacre appearing to be radiately striate. Anterior adductor scar moderately deep, the posterior scar superficial. Sinulus distinctly triangular, its lower end slightly hooked. Prismatic border rather narrow. Pallial line scarcely visible. U.S.N.M. No. 86402. Length, 32 mm. Height, 20 mm. Diameter, 10 mm. Cayenne, French Guiana. Lea collection, from Ferussac.

In the above specimen the microscopic radiating striae described by Marshall<sup>10</sup> as being generally characteristic of *Anodontites* and some other genera show only as faint traces here and there, as they seem to have been scuffed off. The striae figured in that paper on Plate 1, figure 1, do not belong to *crispata* but to a specimen of *luteola* Lea, which had been wrongly identified.

In the foregoing description the three features of most importance are: (1) The triangular sinulus, which was not mentioned by Bruguière; (2) the locality Cayenne, French Guiana, as Bruguière's type came from "les rivières de la Guyanne"; and (3) the peculiar sculpture, which proves that the specimen is of the species *crispata* and that Ortmann was mistaken in his identification of this species in his Carnegie paper of 1921.

*Anodonta puberula* Gould, of which the type is in the United States National Museum (No. 5933), resembles *crispata* in form, but

<sup>10</sup> Proc. U. S. Nat. Mus., vol. 67, art. 4, pp. 1-14, pls. 1-4, 1925.

while it is a true *Anodontites* and groups with *A. tortola* Lea, *A. pittieri* Marshall, and some others that show a rather distant relationship to *crispata*, it is distinctly different from it, as might have been expected from the fact that it comes from Peru, while *crispata* comes from French Guiana.

*Anodon reticulatus* Sowerby, as shown by its description and by specimens in the United States National Museum, does not even belong in the section *Anodontites* s.s. with *A. crispata*, but probably in the section *Styganodon* with *A. tenebricosa* and others.

With the above explanations the synonymy of *Anodontites crispata* Bruguière will be as follows:

1792. *Anodontites crispata* BRUGUIÈRE, Journ. d'Hist. Nat., vol. 1, p. 131, pl. 8, figs 6, 7.

1798. *Anodontites crispata* BRUGUIÈRE, Ency. Méth., vol. 1, pl. 203, figs. 3a, 3b.

1819. *Anodonta crispata* LAMARCK, Hist. Nat. Animaux sans Vert., vol. 6, p. 86 (with a reference to Ency. Méth., pl. 203, figs. 3a, 3b).

1870. *Anodon schomburgianus* Sowerby, Conch. Icon., vol. 17, pl. 34, fig. 137. (British Guiana.)

Haas (1931, p. 95), in his treatment of *A. crispata* Brug., adds the mistakes of Simpson to most of those of Ortmann and hence this portion of his work is to be rejected, except, perhaps, his citation of Cayenne, French Guiana, as the source of one of his specimens. This may be the true *A. crispata*. His citations of localities in Colombia and Ecuador are erroneous. They probably refer to specimens of *A. colombiensis* Marshall (Colombia) and *A. napoensis* Lea (Ecuador). Haas has made matters worse by placing *A. napoensis* Lea in the synonymy of *A. crispata* Brug., while he places the very closely related *A. colombiensis* Marshall in the synonymy of *A. soleniformis* Orbigny.

Marshall (1931, p. 16) describes the new subgenus *Ruganodontites* to include the two species *A. colombiensis* Marshall (type) and *A. napoensis* Lea.

#### NOTE ON THE LASIDIUM

Ihering (1891, p. 480; 1893, p. 48) described and figured the embryo of *Anodontites wymanni* Lea, and stated that the embryos occur in the inner gills. He called the embryo a *lasidium*. Having three pieces it is entirely different from the *glochidium*, which has two pieces, commonly found in naiades. Since that time "lasidium" has had frequent and important mention in classification. Because of Ihering's eminent standing as a naturalist we are compelled to accept his findings until they are proved to be incorrect, but in biology we give great respect to analogy, and his discoveries are so different from what we should expect from the analogy between *Anodontites*, *Diplodon*, *Anodonta*, *Unio*, and other naiades that we



may be pardoned for harboring doubt as to the correctness of his discoveries. Should his observations be confirmed, the fact will lessen our faith in analogy, and we may then doubt that the naiades normally have taxodont hinge, and a number of other beliefs which we accept as truth but which rest upon analogy and not upon absolute proof will have to be discarded.

Ihering seems to be the only naturalist who has seen the embryo of *Anodontites*. Simpson never saw one, nor did Ortmann (1921, p. 567), who says regarding the whole subfamily Mutelinae: "It is a very singular circumstance that I have not been able to find lasidia (or any other form of mature larvae) in my material, although a good many gravid females of various species and genera are at hand." I have been trying for a long time to obtain from naturalists in Costa Rica, Colombia, British Guiana, Venezuela, and Uruguay any species of naiad with a triangular sinus containing ripe embryos, but so far without success. Attention is called to this in the hope that naturalists may be led to make special effort to obtain material that will either confirm or disprove Ihering's results. Proof or disproof would be a great stride forward in our understanding of the naiades.

Notwithstanding the difficulty of obtaining specimens of the Mutelinae containing ripe embryos, it is known from the observations of Ihering and Ortmann that the inner gills form the marsupium. Species belonging in that subfamily may be obtained from Mexico to Patagonia and also in West Africa. Any species showing the characteristic nearly equilaterally triangular sinus or ligamental scar at the rear end of the ligament would probably give the key to the embryology of the whole subfamily, provided it contained ripe embryos. The breeding season is unknown; hence it might be necessary to look for gravid specimens each month in the year until the proper season is discovered. The inner gills when gravid probably become padlike from the multitude of embryos gorging them, while the outer gills remain normal. Ripe embryos in the naiades whose embryology is known are minute white shells consisting of two valves. A little of the inner gill of South American species teased out and examined under a microscope will reveal at once whether embryos are present.

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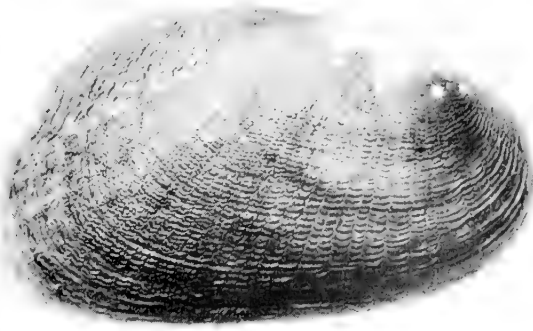
## EXPLANATION OF PLATES

### PLATE 1

- FIGURE 1. *Anodontites crispata* Bruguière, from Cayenne, French Guiana. U.S. N.M. No. 86402,  $\times 2$  diam.
- 2, 3. Photographic copies of Bruguière's figures (1792a), plate 8, figures 7 and 6, respectively.
4. Lamarek's "type" of *Anodonta crispata* in the Paris Museum,  $\times 1\frac{1}{2}$  diam.

### PLATE 2

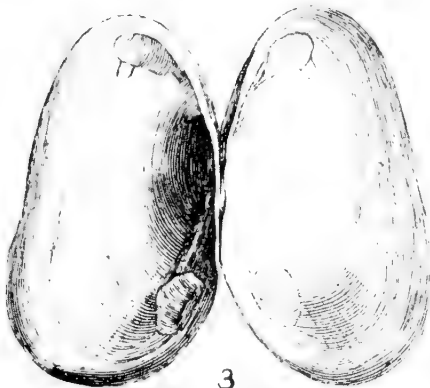
- FIGURE 1. *Anodontites colombiensis* Marshall, natural size. A specimen figured by Ortmann (1921, pl. 41, figs. 2a, 2b), for *A. crispata* Brug. It comes from Rio de la Paila, Paila, Colombia.
2. *Anodontites crispata* Bruguière,  $\times 4$  diam. From U.S.N.M. No. 86402, shown on Plate 1, Figure 1.
3. *Anodontites colombiensis* Marshall,  $\times 4$  diam., sculpture of Ortmann's "*A. crispata* Bruguière," shown in Figure 1 of this plate.
4. *Anodontites colombiensis* Marshall, sculpture of type,  $\times 4$  diam.
5. *Anodontites crispata* Bruguière,  $\times 2$  diam. Dorsal view of U.S.N.M. No. 84402, shown on Plate 1, Figure 1.
6. *Anodontites colombiensis* Marshall. Type, natural size.



1



2



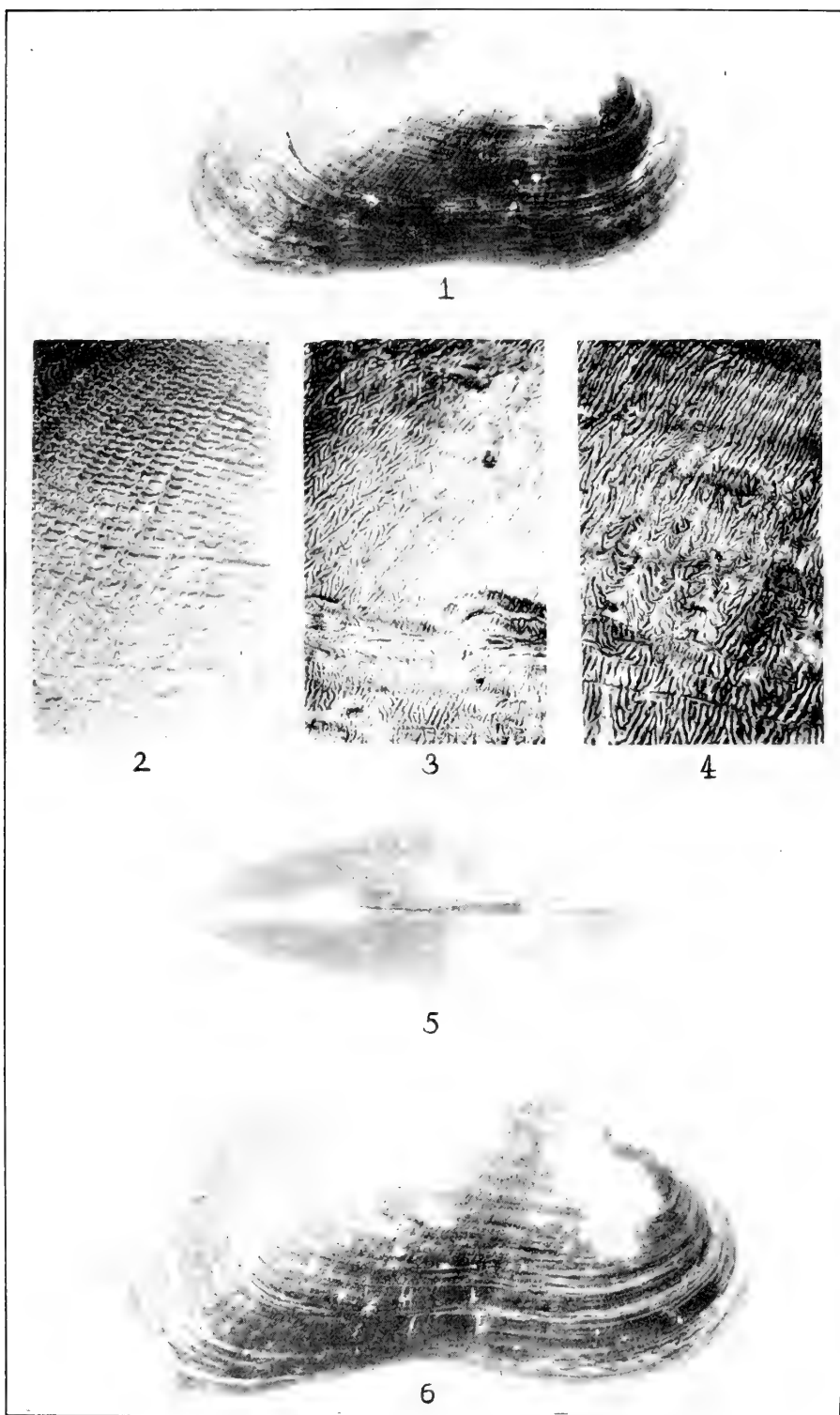
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4

ANODONTITES CRISPATA BRUGUIÈRE

FOR EXPLANATION OF PLATE SEE PAGE 16



ANODONTITES COLOMBIENSIS MARSHALL AND A. CRISPATA BRUGUIÈRE

FOR EXPLANATION OF PLATE SEE PAGE 16.

# THREE NEW PARASITIC NEMATODE WORMS

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By MARY SCOTT SKINKER

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The nematodes described in this paper are from three sources. The first one, a species of *Metabronema*, is from a fish host and was collected by Mrs. M. Q. Bowman, of the Amory-Smithsonian expedition, from the region of the Matamek River, Province of Quebec, Canada. The specimens of *Passalurus* were collected by R. G. Meader, of Hamilton College, Clinton, N. Y. Those designated as *Metatheziasia* were collected by Dr. M. C. Hall and Dr. Eloise B. Cram, of the zoological division, from viscera forwarded to the Bureau of Animal Industry by F. W. Koehler, of the Bureau of Biological Survey.

## Family SPIRURIDAE Oerley, 1855

### Subfamily SPIRURINAE Railliet, 1915

#### METABRONEMA CANADENSE, new species

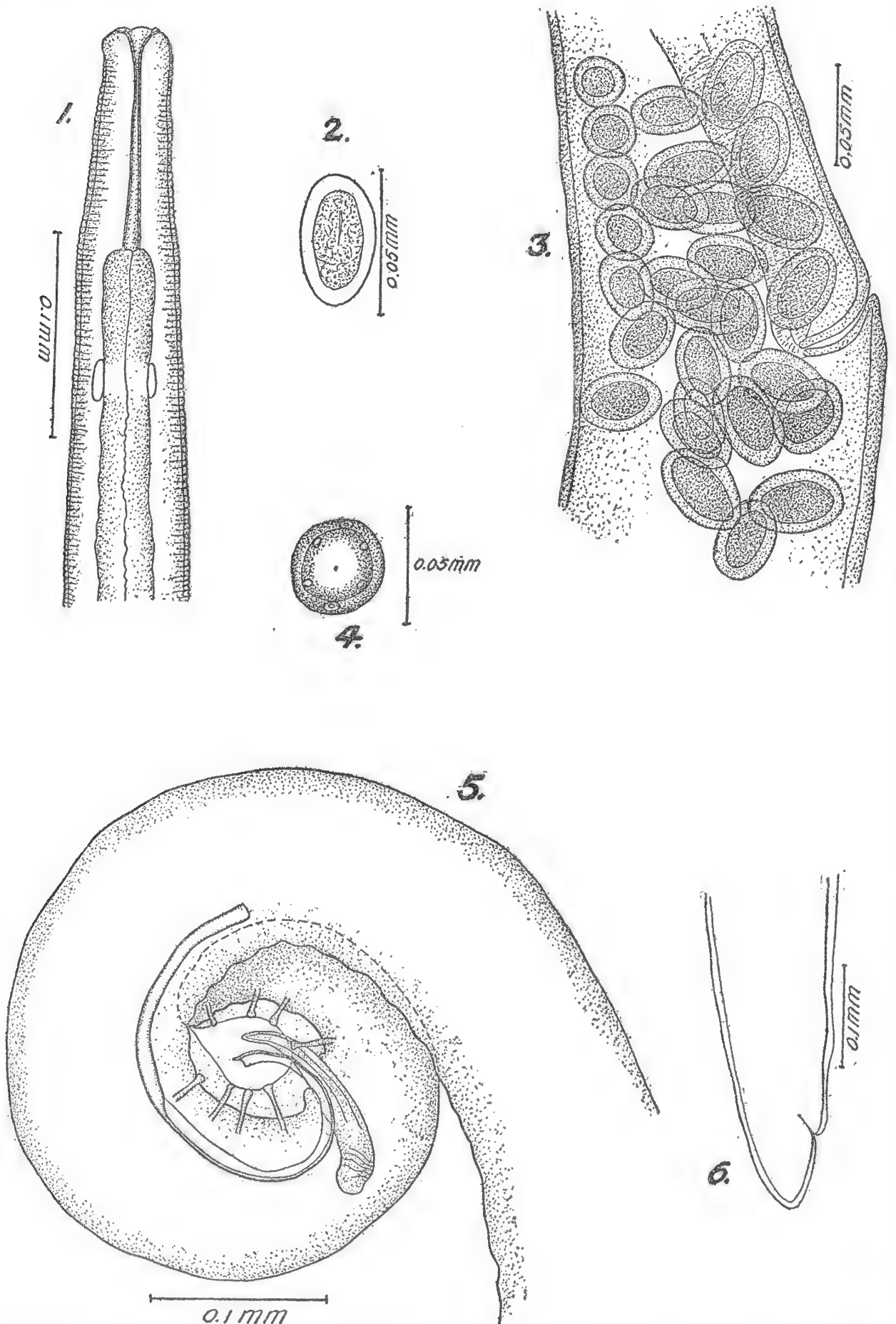
#### FIGURES 1 TO 6

*Specific diagnosis.*—*Metabronema*: The head measures  $38\mu$  to  $40\mu$  in diameter. Oral aperture simple. The esophagus varies in length from 2.135 mm. to 2.8 mm. Transverse cuticular striations are conspicuous in the anterior fifth of the body, the distance between them being about  $5\mu$ . The nerve ring is situated near the anterior end of the esophagus, about  $60\mu$  from the posterior end of the vestibule. Cervical papillae were not observed.

*Male*, 5.8 mm. to 7.1 mm. in length with a maximum diameter of  $205\mu$ . The anterior portion of the esophagus is  $900\mu$  to  $960\mu$  long; the posterior portion is about 1.27 mm. long. The tail is spirally coiled, making two or three complete coils. Caudal alae are conspicuous and are provided with four pairs of pedunculated preanal papillae, the posterior pair being located close to the cloacal opening. The spicules are unequal, the right one  $330\mu$  long, the left  $115\mu$  long.

*Female*, 9.5 mm. to 10.4 mm. long, with a diameter at the vulva of about  $150\mu$ . The anterior portion of the esophagus is about  $800\mu$  long, the posterior portion about 2 mm. long. The vulva is located

near the equator of the body, and the anus is about  $60\mu$  from the posterior end of the body. The eggs, which are in the morula stage in the uterus, are thick shelled and are  $38\mu$  to  $46\mu$  long by  $23\mu$  to  $29\mu$  wide; the thickness of the shell is about  $5\mu$ ; no polar filaments were demonstrable.



FIGURES 1-6.—*Metabronema canadense*: 1, Anterior end of male; 2, egg; 3, region of vulva; 4, head of male, en face view; 5, posterior end of male; 6, posterior end of female



*Hosts*.—Primary: *Salvelinus fontinalis*; secondary: Unknown.

*Location*.—Not recorded; presumably the digestive tract.

*Distribution*.—Canada (Matamek River, Province of Quebec).

*Type specimen*.—U.S.N.M. Helm. Coll. No. 8035.

*Remarks*.—This form fails in several details to conform to the generic diagnosis given by Yorke and Maplestone (1926). There is no gubernaculum, and the pair of sessile papillae near the tip of the tail of the male was not observed. It is possible that the latter is present, but the tail is so tightly coiled that with the limited material at the writer's disposal it seemed better to leave this point undetermined than to risk the destruction of a specimen in further attempts to demonstrate these papillae. The eggs possess no polar filaments.

With only two species in a genus it is difficult to determine which characters are of generic rank and which are of only specific value; therefore, it is preferable to leave the generic definition unchanged until adequate evidence is obtained to enable one to evaluate these characters.

### Family OXYURIDAE Cobbold, 1864

#### PASSALURUS NONANULATUS,<sup>1</sup> new species

##### FIGURES 7 TO 11

*Specific diagnosis*.—*Passalurus*: Mouth with 3 lips surrounded by 4 submedian papillae and 2 amphids. Within the short vestibule are three curved teeth surrounding the opening to the esophagus. Cervical papillae are not apparent. The cervical alae are notched about  $372\mu$  from the anterior end.

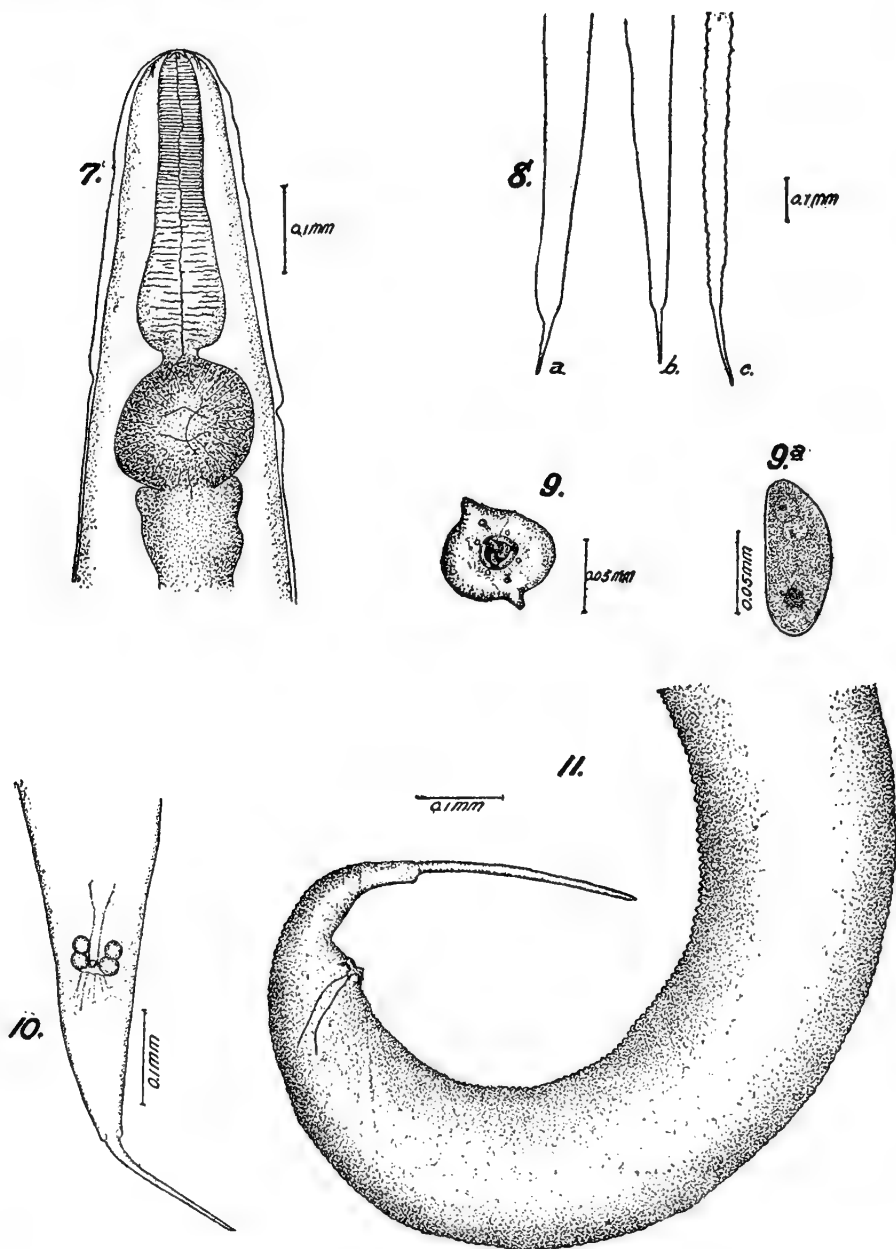
*Male*, 3.4 mm. to 4.1 mm. long, with a maximum width of about  $272\mu$ . The width of the head is about  $38\mu$ . The entire esophagus is  $395\mu$  to  $403\mu$  long. The bulbar region is about  $114\mu$  long and  $122\mu$  wide. The narrow posterior portion of the tail is about  $213\mu$  long. There are two pairs of circumanal papillae, and a pair of smaller papillae is situated at the point where the narrowing of the diameter of the tail takes place. One pair of the circumanal papillae is preanal, the other postanal. Both pairs are situated close to the cloacal aperture. The spicules are  $114\mu$  long.

*Female*, 7.2 mm. to 8 mm. long, with a maximum diameter of  $400\mu$  and a width at the anterior end of  $46\mu$  to  $68\mu$ . The esophagus measures  $524\mu$  to  $555\mu$  in length, the bulb alone being  $144\mu$  to  $160\mu$  long and  $144\mu$  to  $167\mu$  wide. The vulva is situated about 1.6 mm. from the anterior end and the anus about 1.6 mm. from the posterior end.

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<sup>1</sup> Harpers' Latin Dictionary gives the word *anulus* with the single "n." Therefore, it is preferable to retain this spelling for a specific name based upon that word.

The slender portion of the tail is  $152\mu$  long. Two ovaries are present. The eggs are thin shelled and  $85\mu$  to  $129\mu$  long and about  $60\mu$  wide; they are unsegmented.



FIGURES 7-8b.—*Passalurus nonanulatus*: 7, Anterior end of male; 8a, posterior end of female from *Canis lestes*; 8b, posterior end of female from *Lepus americanus*  
FIGURE 8c.—*Passalurus ambiguus*: Posterior end of female, showing the moniliform condition

FIGURES 9-11.—*Passalurus nonanulatus*: 9, En face view; 9a, egg; 10, posterior end of male, ventral view; 11, posterior end of male, lateral view

*Hosts*.—American varying hare (*Lepus americanus*), coyote (*Canis lestes*).<sup>2</sup>

*Location*.—Small intestine.

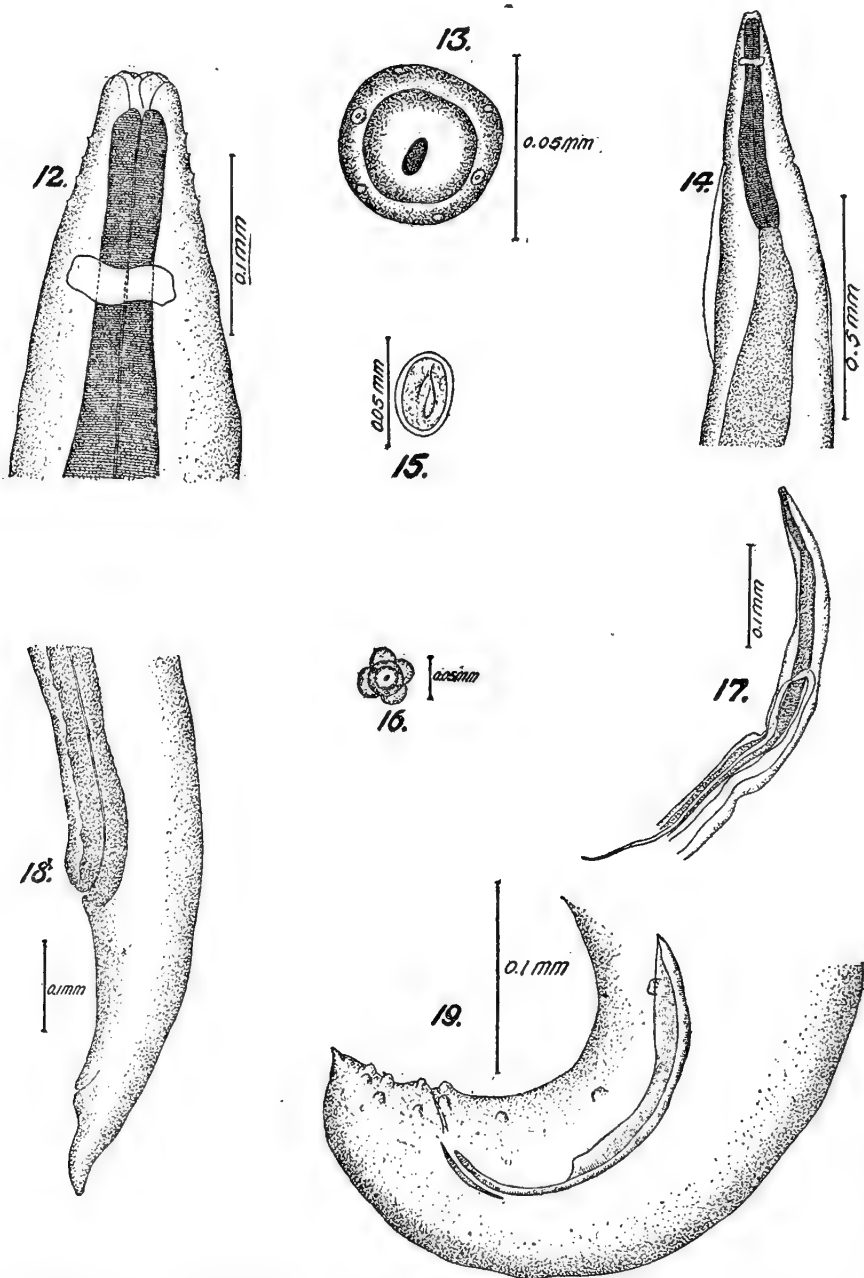
*Distribution*.—United States (Cheboygan County, Mich., and Olympia, Wash.).

*Type specimen*.—U.S.N.M. Helm. Coll. No. 28463.

*Remarks*.—This species lacks the annulations found on the tail in mature females of *Passalurus ambiguus*. It is impossible, however, to determine in all cases in the earlier literature whether the author was describing a form in which the mature females possessed a moniliform tail. Both Schneider (1866) and von Linstow (1899), as well as Rudolphi (1819), fail to mention annulations if they were present in the mature females described by them. Dujardin (1845), on the other hand, mentions them. This leaves it a question as to whether one or more species of *Passalurus* have been observed up to the time of this report, but *P. ambiguus* is now established as showing a moniliform condition in the female tail. The spicules in both species are about the same size, but they differ slightly in shape. The anal papillae of *P. nonanulatus* are not in agreement with those in the description of *P. ambiguus* given by Danheim and Ackert (1929) and that of Hall (1916); therefore the two species differ in this respect. Danheim and Ackert give the number of these papillae for *P. ambiguus* as five, and so also does Hall. The writer has examined in ventral view many specimens of *P. nonanulatus* and finds only the two pairs of anal papillae as described. Hall (1916) and Danheim and Ackert (1929) agree in reporting for *P. ambiguus* an unpaired papilla located directly behind the cloacal aperture, but among other authors there is little agreement in regard to the number of perianal or adanal papillae assigned to this species. In favorable mounts of *P. ambiguus* the appearance of this "unpaired" papilla is such as to suggest that it represents the fusion of two papillae. Seurat (1916) describes and illustrates three pairs of large perianal papillae and a small pair situated immediately posterior to the cloacal aperture. Von Linstow (1899) describes and illustrates only two pairs of perianal papillae. Dujardin (1845) does not mention any such papillae, and Schneider (1866) indicates only one pair as situated near the cloacal aperture, although another pair is described and illustrated by him as approximately at the side or "fast seitlich stehend." Yorke and Maplestone (1926) describe three pairs of large "pericloacal papillae." The pair of papillae situated at the point

<sup>2</sup> The specimens of this species from the coyote (*Canis lestes*) (U. S. N. M. No. 26736) were collected by Dr. E. B. Cram, the intestine of the host having been sent from Olympia, Wash., to the Bureau of Animal Industry by Dr. Glenn R. Bach, formerly of the Bureau of Biological Survey. The presence of *Passalurus nonanulatus* in a carnivore undoubtedly represents a case of spurious parasitism following the ingestion of the normal host, the hare, by the coyote.

where the tail narrows in diameter is much less conspicuous in *P. nonanulatus* than in *P. ambiguus*. No caudal alae are present in *P. nonanulatus*.



FIGURES 12-19.—*Metathelazia californica*: 12, Anterior end of male, showing cervical serrations; 13, head of male, *en face* view; 14, anterior end of male; 15, egg; 16, anterior view of head, showing the quadripartite condition in the region of the vestibule; 17, anterior half of male, showing loop in the testis; 18, posterior end of female, showing vulva and anus, lateral view; 19, posterior end of male, lateral view

## Family THELAZIIDAE Railliet, 1916

## METATHELAZIA, new genus

*Generic diagnosis.*—Thelaziidae: Mouth without lips but followed by a vestibule in the region of which the body wall is divided by indentations into 4 pillarlike structures giving the quadripartite appearance of the head in anterior view (fig. 16); 4 submedian papillae and 2 amphids; esophagus muscular throughout, enlarged posteriorly, the fibers of this portion being coarser than those of the anterior portion, which gives the appearance of 2 parts to the esophagus. Males with tail bluntly pointed and recurved, without caudal alae; seven pairs of sessile caudal papillae of which four pairs are preanal; spicules equal and transversely striated; gubernaculum present. Females with tail slightly curved and pointed; vulva near anus; uterus apparently double. Oviparous; morulated eggs with a thick shell.

*Type species.*—*Metathelazia californica*, new species.

## METATHELAZIA CALIFORNICA, new species

## FIGURES 12 TO 19

*Specific diagnosis.*—*Metathelazia*: Cuticle longitudinally striated. Mouth without lips. Diameter of head about  $38\mu$ . Four or more cuticular folds or serrations are present in the cervical region. The most anterior fold is situated about  $38\mu$  from the anterior tip of the head and each of the other folds is about  $12\mu$  posterior to the one preceding it. The club-shaped esophagus is  $500\mu$  to  $640\mu$  in length and has a maximum width of about  $68\mu$ . The anterior portion is  $182\mu$  to  $190\mu$  in length. The nerve ring is about  $122\mu$  from the anterior end.

*Male*, 6.6 mm. long with a maximum diameter of  $352\mu$ . The esophagus is  $502\mu$  in length and has a maximum diameter of  $72\mu$ . Of the seven pairs of caudal papillae, three pairs are postanal. The testis is a prominent structure originating about midway between the anterior and the posterior ends of the body. It passes anteriorly to a point about one-sixth of the distance from the anterior end where it forms a loop and passes posteriorly to the region of the cloaca. The spicules are equal,  $225\mu$  long, their greatest width being  $25\mu$ . The gubernaculum is crescent shaped and about  $42\mu$  long.

*Female*, much larger than the male; estimated from fragments procured from the lynx, the total length of the mature female is about 20 mm. or longer. Maximum width about  $241\mu$ ; the width at the anus about  $76\mu$ . The anus is about  $110\mu$  from the posterior end of the body and the vulva about  $320\mu$  from the end. The ovary appears

to be double. The eggs are numerous and thick shelled,  $38\mu$  to  $40\mu$  long by  $25\mu$  to  $30\mu$  wide. Most of them are in the morula stage, while in those most fully developed the vitelline membrane is shrunk away from the shell, thus concealing the details of the stage of development reached. No further details could be determined from the fragmentary specimens.

*Hosts*.—Primary: *Lynx* (*Lynx rufus californicus*), puma (*Felis hipposlestes*); secondary: Unknown.

*Location*.—Lungs.

*Distribution*.—United States (Lassen County, Calif., and Las Vegas, N. Mex.)

*Type specimen*.—U. S. N. M. Helm. Coll. No 25337.

*Remarks*.—The genus to which *Metathelazia* is most closely related is *Thelazia*. The two genera are similar in the following characters: The mouth is without lips; a buccal capsule or vestibule is present; the esophagus is moderately short; the tail of the male is recurved and is without caudal alae; cervical serrations are present.

The genus *Metathelazia* may be distinguished from the genus *Thelazia* by the fact that in the former the vulva is in the posterior region of the body, the spicules are equal, the preanal papillae are limited to four pairs, the cervical serrations are less conspicuous and fewer in number, and the members of the genus are found in the lungs of mammals.

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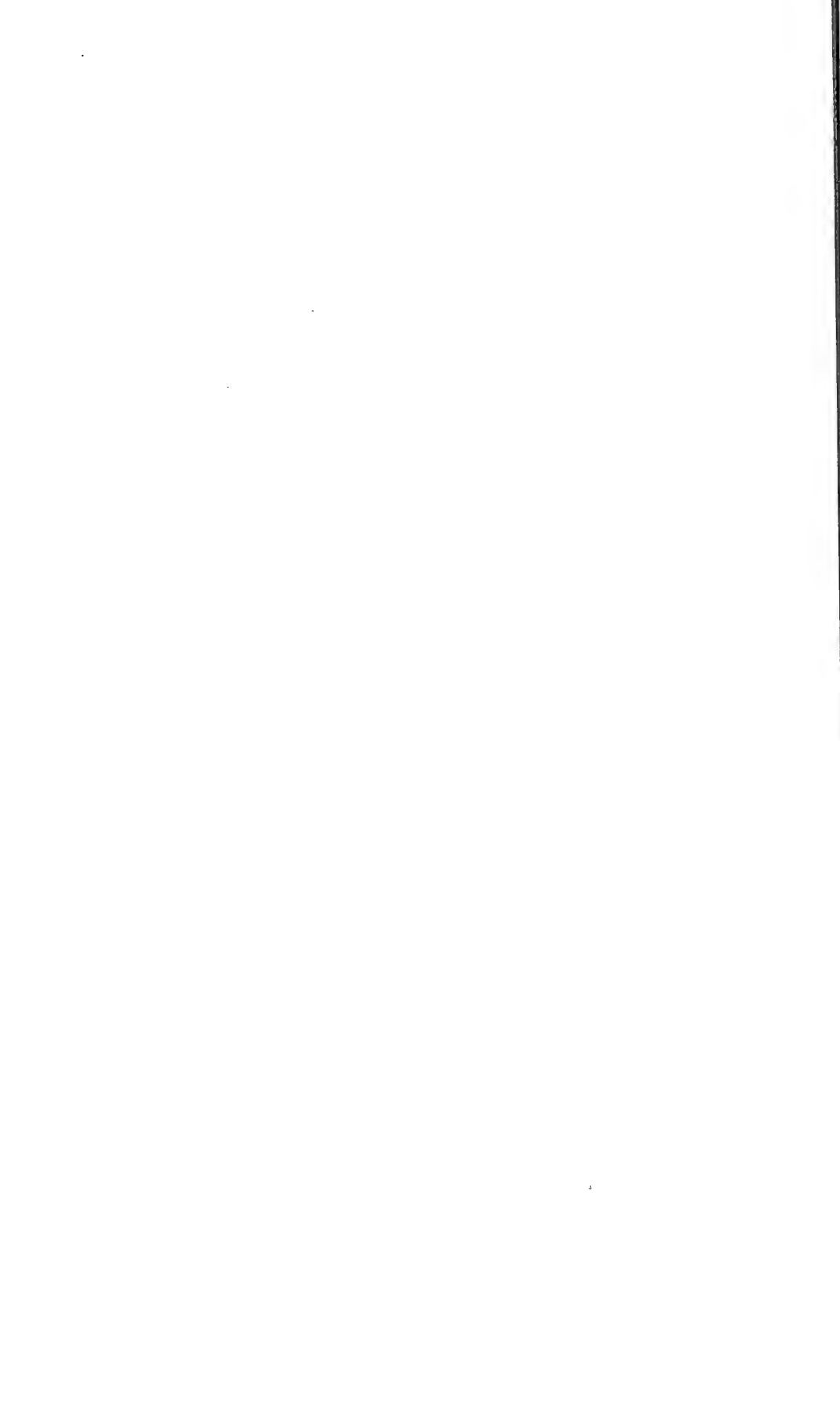
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# REPORT ON A COLLECTION OF INSECTS OF THE ORDER TRICHOPTERA FROM SIAM AND CHINA

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The trichopterous fauna of Szechwan is a very interesting and apparently very rich one. Nearly all the species found proved to be new. It is not a typically Chinese fauna, but resembles more that of the eastern Himalayas and of Tibet.

The material herein described is all in the United States National Museum. The Chinese portion was collected by Dr. D. C. Graham, of Suifu, Szechwan Province, China, while the Siamese specimens were taken by Dr. W. L. Abbott.

## Family RHYACOPHILIDAE

### Genus RHYACOPHILA Pictet

#### RHYACOPHILA SINENSIS, new species

#### PLATE 1, FIGURES 1, 2

*Description.*—Head and thorax brown. Anterior femora brownish, median and posterior ones yellowish; anterior and median tibiae brown, with yellow markings; posterior tibiae yellowish; tarsi brownish. Abdomen brownish, yellowish beneath. Anterior wings brownish, with indistinct pale reticulation; second apical fork a little basad of the first. Posterior wings subhyaline, pterostigma opaque; second apical fork beginning clearly earlier than the first one. *Male*: Ninth tergite with a long, narrow median process, which is directed downward and somewhat dilated at its apex. The hind margin of the ninth tergite at the sides of the median process is blackish and forms two small projections directed backward. Inferior appendages<sup>1</sup> brownish; the basal joint, viewed laterally, is broad; second joint subdivided by a broad triangular excision into two lobes, the upper one broad, subtriangular, the lower one of the

<sup>1</sup> I use this term for *pedes genitales* of authors.

same length, but only about one-half as broad. Seen from above, both these lobes are narrow, somewhat dilating to their rounded ends. Penis long and very slender, somewhat curved in S-shape; titillators a little shorter, but also long and slender, acute at their ends; both penis and titillators brown. Length of body, 9 mm.; that of the anterior wings, about 13 mm.

Allied to *Rhyacophila hobsoni* Martynov (Tibet).

*Type*.—Male, U.S.N.M. No. 43156, collected at Yellow Dragon Temple, near Songpan, Szechwan, 11,000 to 14,000 feet altitude, July 25–28, 1924.

*Specimens examined*.—One, the type.

#### RHYACOPHILA species

*Description*.—Anterior wings brown, with distinct pale irroration; second apical fork a little basad of the first, but the footstalks of both forks are short, much shorter than in preceding species; the forking of Rs in the posterior wings is similar to that in the anterior ones. Apparently a distinct species. Length of body, 7 mm.

*Specimens examined*.—One female, from Yellow Dragon Temple, near Songpan, Szechwan, 11,000 to 14,000 feet altitude, July 17–20, 1924.

#### Genus GLOSSOSOMA Curtis

#### GLOSSOSOMA ANALE, new species

#### PLATE 1, FIGURES 3 TO 7

*Description*.—Head and thorax brown above; antennae yellow, with brownish annulations; apical portion darker; palpi brownish. Side of thorax yellowish. Femora yellow; tibiae brownish yellow; tarsi also somewhat brownish; spurs 1, 4, 4, long, brown. Abdomen brown above, ochraceous beneath; genital segments dark yellow. In females tibia and basal tarsal joint of the median legs dilated; spurs similar to those in male, long, dark brown. Anterior wings (male) somewhat brownish, resembling those of *G. valvatum* Ulmer; discoidal cell somewhat elongated; media approximated to CuA in its basal portion, but united with it at a point only;  $M_{3+4}$  approximated at its base to  $CuA_1$ ;  $CuP^2$  slender;  $A_1$  and  $A_2$  thick, distinct;  $A_2$  arcuate and strongly convex backward, inclosing with  $A_1$  a large subelliptical opaque area. The venation of the posterior wings is similar to that of *G. valvatum* Ulmer, but the discoidal cell is somewhat longer; second apical cell narrow at its base; third apical fork twice as long as its footstalk.

<sup>2</sup>  $CuP$  is a term I introduce for  $A_1$  of authors, changing their  $A_2$ – $A_4$  to  $A_1$ – $A_3$ , respectively.

*Male*: Ninth dorsal segment very broad, forming above a broad, subtriangular projection; ventral portion very narrow, covered by the eighth segment; seventh sternite forming a transverse arcuate platelike projection; the base of the sixth sternite provided with a large platelike appendage, almost square, if seen in front, but its hind margin appears as if broken.

The tenth segment is divided into two lateral portions, each of which is also divided by a deep oval excision into two lobes or processes. Upper, or inner, processes are long, slender, and acute at their ends, curved downward (if viewed laterally). Lateral lobes are much shorter, triangular from side, rounded at their ends above, bearing numerous long hairs. These lateral lobes are united at their bases with large basal pieces, forming internally two other lobes, similar to these, but shorter, pale, and bearing several stiff blackish curved hairs.

Unpaired median process of the ninth tergite long and broad, its left margin straight, the right one convex, arcuate; apical portion narrow, almost claw-shaped, with apex directed to the right side. Penis not exerted in our specimens. In the female the wing venation is similar to that in the male, except the anal region. There is but a small tooth on the sixth sternite. Length of body, 5.5 to 6.5 mm.; expanse, 16 mm.

In the structure of male genital segments this species resembles *Glossosoma valvatum* Ulmer, but differs obviously by the configuration of anal region in the anterior wings, as well as by the structure of the tenth segment.

*Type*.—Male, U.S.N.M. No. 43163.

*Specimens examined*.—Two males and two females, including the type, from Shin Kai Si, Mount Omei, Szechwan, July 1–27, 1922; one male, from Shin Kai Si, Szechwan (4,400 feet), July, 1922.

GLOSSOSOMA CAUDATUM, new species

PLATE 1, FIGURES 8 TO 11

*Description*.—Head and thorax blackish brown above, with yellowish hairs. Antennae yellow, with brown annulations, which are broader than in *G. anale*; distal portion of antennae brownish, basal joint testaceous. Thorax brownish yellow laterally; legs dark yellow. Abdomen brownish above, yellow beneath; ninth and tenth segments yellow. Anterior wings brownish or fumose; their venation is similar to that of *G. anale*, differing chiefly in the configuration of the anal region.  $A_1$  sinuate;  $A_2$  directed rather downward, to the base of the “anal callosity”; this structure is very distinct, transverse, pale yellow, raised upward.

*Male*: Ninth dorsal segment not so broad as in *G. anale*, its posterior margin being only feebly convex, if seen dorsally. Transverse

projection of the seventh sternite as in that species; appendix of the sixth sternite very large, longer than in *G. anale*, but narrower, forming an elongated plate, truncate at its end.

Tenth segment divided into two lateral portions, as in *G. anale*. Basal part of each lateral portion broad, forming, laterally, a rounded ventral angle, bearing several black stiff hairs; upper and inner part produced into a long and thick process, narrowing to its apex if viewed laterally; seen from above, each of these portions is thickened in the middle, apical portion excised and thus forming two small blackish teeth. Both lateral portions of the tenth segment are united in their basal portions by the median pale and unchitinized membranous portion. Internally one may make out two small projections of the tenth segment, but they are invisible externally. The unpaired process of the ninth sternite is broad and triangular in its basal portion, but its distal portion is slender, fingerlike and long, clothed with yellow hairs. Above it is a very long process, slender, rodlike, and somewhat thickened in its distal portion; apically it bears a small slender appendix, acute at its end. This structure belongs to the penis. Length of body, 5 mm.

This is a very distinct species, but apparently allied to both *Glossosoma anale* and *G. valvatum*.

*Type*.—Male, U.S.N.M. No. 43164.

*Specimens examined*.—Two males, from Shin Kai Si, Mount Omei, Szechwan, July, 1922.

## Family STENOPSYCHIDAE

### Genus STENOPSYCHE McLachlan

#### STENOPSYCHE LAMINATA Ulmer

Length of anterior wings is 21.5–22.2 mm.; color pale yellowish, with numerous brown transverse bands, but usually without large spots; postcostal area mostly pale but with traces of reticulation. Described originally from China.

*Specimens examined*.—Two males and two females, from Shin Kai Si, Mount Omei, June, 1921; two females, Shin Kai Si, Mount Omei (4,400 feet), September, 1921; one male, Shin Kai Si, Mount Omei (without date).

#### STENOPSYCHE GRAHAMI, new species

#### PLATE 1, FIGURES 12, 13

*Description*.—A rather large form, allied and similar to *Stenopsyche navasi* Ulmer. Body yellowish brown. Head clothed with yellowish and whitish hairs; antennae yellow with brown reticula-

tion. Legs yellow; anterior and median legs somewhat reddish, with broad, dark-brown markings. Anterior wings with dark-brown reticulation, forming sometimes two large, distinct, brown spots—one in the middle of the wing, the other nearer to the base. In the specimen from Suifu the basal portion of the wings is also dark brown. Apical portion triangular, but not extended. Hind wings pale, whitish, with apical portion somewhat fumose. *Male*: Lateral portions of the ninth segment large, broad, triangular, posteriorly extended, forming two fingerlike hairy processes. Tenth segment transverse, shorter than in *S. navasi* Ulmer. Its median portion forms a distinct elevation above; seen from above, it is triangular at its base, but narrow in its distal part. The apical portion of this elevation is surrounded by a yellow platelike structure, forming a median tonguelike process, not very long. Lateral portions of the tenth segment broad, above, posteriorly with two pairs of short processes, one pair near the median tongue-shaped process, the other one at the middle of the hind margin; hind outer portions somewhat tuberculated, with several bristles. Upper portions of the inferior appendages long, straight in their basal portions (behind the tenth segment, above), then curved outward; apical portions somewhat thickened and forming, externally, two short prominences or processes, somewhat varying in length. Lower portions of the inferior processes also rather long; seen from beneath they are narrow, with apical margin obliquely truncate. Preanal appendages long, hairy, as usual. Penis with two minute acute appendages at its apex. Length of body, 18 to 20 mm.; expanse, 55 to 61 mm.

This species, doubtless, is allied to *S. navasi* Ulmer (Tient-Tsuen, in Shantung). The tenth segment is formed on the same plan, but its median portion in *navasi* is extended backward much more than in *grahami*. Upper portions of the inferior appendages in *navasi* shorter, strongly curved outward, knee-shaped, if seen from above.

*Type*.—Male, U.S.N.M. No. 43153.

*Specimens examined*.—Two females and one male, from Shin Kai Si, Mount Omei, Szechwan; one female, same locality (4,400 feet), July 1–14, 1921; one male, same locality, July 17, 1922; one female, same locality (6,000 to 7,500 feet), August 21, 1921; one male, same locality (5,000 to 11,000 feet), August 24–27, 1921; one female, Suifu, Szechwan, September 6 to October, 1921.

STENOPSYCHE SIAMENSIS, new species

PLATE 2, FIGURES 14, 15

*Description*.—Body reddish brown. Head reddish, with reddish-yellow antennae; ocelli distinct. Legs reddish yellow, anterior and

median ones with usual dark markings. Anterior wings somewhat shorter than usual, with obliquely truncated apical margin. Coloring much paler than usual; the brown reticulation is represented chiefly by a series of short transverse stripes and a few brown spots, partly anastomosing; in the region of the discoidal cell and pterostigma a rather large pale spot, and a little nearer to the base is placed a second pale spot between C and Rs; postcostal area and anal areas also pale. Posterior wings in their ano-jugal region not so dilated as in the remaining species; apical portion a little darker, yellowish.

*Male*: Side pieces of the ninth segment broad, but shorter than the tenth segment, upper posterior angle forming a short and narrow triangle. Tenth segment large and of a very composite structure. It forms two side and one median ventral portion; the last-mentioned part forms two long and thick (if seen from above) processes, directed posteriorly; their tips are curved upward, slender and acute. The lateral portions are broad above, as well as laterally, and at their base there is, above, an oval convexity; their apical portions each form three or four slender processes, one ventral, one (or two) lateral, and one dorsal; upper processes longer than the other and directed obliquely upward and inward, with apices acute and crossing each other. Preanal appendages long and almost straight. Lower portions of the inferior appendages stick-shaped, but rather short. Upper portions very short; basally they are directed upward, as in other species, but almost immediately divide into two slender processes; the lower portion is short, directed posteriorly, with acute apex, turned upward; the upper process is longer, rod-shaped, directed obliquely upward, with somewhat thickened apical portion. Penis not exerted in our specimens.

The plates and processes of tenth segment are somewhat polished and brownish; the inferior appendages are also somewhat brownish. Length of body, 10 to 11 mm.; expanse, 24 to 26 mm.

*Remarks*.—This is a small and peculiar form, differing chiefly by the shape of its wings and by the short, forking upper portion of the inferior appendages. In the configuration of the lateral portions of the ninth segment, however, as well as in the structure of the tenth segment, one may appreciate some resemblance to *denticulata* and *longispina* of Ulmer. In *denticulata* the tenth segment is differentiated into two side, and one median portion, but the side portions are slender, the median portion is entire, with but short end processes. In *longispina* the side portions of the tenth segment form similar dorsal processes, crossing each other, but the median portion is also entire and long. In any case *siamensis* is allied to the group

of species *denticulata*, *longispina*, and *similis* of Ulmer, though representing a very distinct species.

*Type*.—Male, U.S.N.M. No. 43154.

*Specimens examined*.—Two males, from Khow Sai, Trong, Lower Siam, January-February, 1899.

## Family HYDROPSYCHIDAE

### Genus MACRONEMA Pictet

#### MACRONEMA FASTOSUM Walker

The specimen examined belongs to the color variety of *Macronema fastosum* var. *fasciatum* Albarda; apical portion of the anterior wing, behind anastomosis, is of the same dark-yellow color as its basal portion; fuscous stripe somewhat dilated anteriorly.

*Specimens examined*.—One male, from Khow Sai, Dow (1,000 feet), Trong, Lower Siam, January-February, 1899.

### Genus HYDROPSYCHE Pictet

#### HYDROPSYCHE APPENDICULARIS, new species

#### PLATE 2, FIGURES 16 TO 18

*Description*.—Head brownish, clothed with golden-brownish hairs. Thorax brownish; anterior legs brownish, median and posterior ones paler, yellowish; in the females the tibia and tarsus of the median legs are dilated, but not very strongly; anterior legs slender, feeble. Anterior wings pale brownish, irrorated with numerous, partly confluent, hyaline spots, so they may be called pale yellowish, reticulated with brownish; pale spots clothed with golden-yellow hairs. Posterior wings pale; median cell closed. Fringe of the apical margin of anterior wings yellowish with blackish interruptions. Abdomen brownish above, paler beneath. *Male*: Ninth tergite with a short triangular median projection, the dorsal plate (tenth segment) forming two pairs of short posterior projections; the upper projections are subtriangular, rounded dorsally, slender from side, bearing short hairs at their ends. Lower projections shorter but broader and rounded; at their outer edge they form two very long slender processes, nearly reaching the ends of the inferior appendages; viewed laterally they are curved upward, then downward and backward. Basal joint of the inferior appendages long and somewhat thickened in their apical portions; second joint short, slender, curved inward. From the apical portion of the penis arises, beneath, a rather long lobe, which by a deep excision is divided into two nar-

row secondary lobules; basal portion of the lobe is slender, in the shape of a pedicel. At the sides of this pedicel are placed two projections, with acute proximal ends directed basally. Length of body, 6.5 mm.

This is a very distinct species.

*Type*.—Male, U.S.N.M. No. 43165.

*Specimens examined*.—One male, from Shin Kai Si, Mount Omei, Szechwan; one male and one female, same locality, July 1-17, 1922.

**HYDROPSYCHE PENICILLATA, new species**

PLATE 2, FIGURES 19 TO 21

*Description*.—Head brownish yellow, with yellowish hairs. Antennae yellow with broad dark annulations; palpi brown. Eyes prominent, black. Thorax yellowish brown; anterior legs brownish, median and posterior ones yellow. Anterior wings brown, with distinct small pale spots, bearing groups of golden-yellow hairs; hind margin truncate. Posterior wings pale, becoming blackish gray apically; median cell open; first apical fork small, sometimes lacking. Abdomen dark brown above, brownish beneath, tenth segment (male) yellowish brown, inferior appendages yellowish. *Male*: Ninth tergite triangularly produced. Tenth segment large, its hind margin with a shallow median excision, at the sides of which arise two slender rod-shaped processes, directed somewhat downward and inward; the tips of these processes reach the ends of the basal joints of the inferior appendages and bear minute setae. Basal joint of the inferior appendages long, somewhat thickened in its distal portion; second joint gradually tapering to its apex. Penis of a very complex structure. Its apical portion appears to be tubular, truncate at its tip, containing, in its interior, two brushes of blackish setae. From the base of this apical portion arise two small lateral processes, bearing at their ends two minute spinules, which are directed basally. Before the end, the upper portion of the penis is raised upward in the shape of two nearly oval prominences; a little nearer to the base there are two more small lateral projections. Length of body, 6.5 mm.

This is a peculiar species, somewhat resembling *Hydropsyche columnata*, new species, in the structure of the tenth segment and of the inferior appendages, but it is quite distinct.

*Type*.—Male, U.S.N.M. No. 43167.

*Specimens examined*.—One male (July-August, 1922) and one female (?) (March-April, 1925) from Suifu, Szechwan.



**HYDROPSYCHE COLUMNATA, new species**

PLATE 2, FIGURES 22 TO 24

*Description*.—Head yellowish above, laterally brown; antennae yellow with brownish annulations; palpi testaceous. Thorax dark yellow. Legs dark yellowish with long brownish spurs. Anterior wings testaceous, with paler irrorations, clothed with golden-rufous hairs. Abdomen brownish, paler beneath. *Male*: Ninth tergite with a broad triangular projection. Tenth segment subquadrate, above, resembling somewhat that in *Hydropsyche penicillata*, with two analogous posterior processes, but these processes are here much thicker, directed backward and somewhat clavate if seen from above. Inferior appendages with long basal and short distal joints, basal joint gradually thickening to its end. The end of penis produced beneath into a large lower lobe or valve, which by a deep rounded excision is subdivided into two lateral lobes; both these lobes are narrow at their bases, dilated and capitate in their distal portions. Above the base of the lower lobe are placed two dark rounded projections. Length of body, 6 mm.

This is a distinct species, somewhat resembling *Hydropsyche appendicularis*, new species, and *H. penicillata*, new species, but more evidently allied to *Hydropsyche valvata* Martynov, from southwestern Siberia.

*Type*.—Male, U.S.N.M. No. 43166, from Shin Kai Si, Mount Omei, Szechwan, July 1–17, 1922.

*Specimens examined*.—One, the type.

**Genus HYDROMANICUS Brauer****HYDROMANICUS INTERMEDIUS, new species**

PLATE 2, FIGURES 25 TO 27

*Description*.—The specimen examined is somewhat defective; the anterior wings were partly broken, and abdomen was separated. Closely allied to *Hydromanicus frater* Ulmer and perhaps in lesser degree to *Hydatopsyche melli* Ulmer.

Head and thorax dark brown above; anterior portion of the head (clypeus) clothed with very short whitish pubescence. Antennae long, slender, yellowish, with dark spiral line in their basal portion; distal portion with brown annulations. Thorax brownish yellow at sides; legs yellow, with long yellow spurs; fifth joint of tarsi with two distinct claws. Anterior wings yellowish, with brownish reticulation, forming indistinct transverse fasciae, partly anastomosing along

the veins, where the brown color is more distinct. Venation brown; at cross veins there are mostly brownish spots; a somewhat paler spot is placed between DC and the end portion of CuP, occupying the distal portion of MC. SC unites at its end with R and thus a short common vein is formed, ending very near to Rs; first apical fork rather long, discoidal cell short; median cell long, fourth apical fork beginning nearly at the same level with the third fork; cross vein between basal portions of  $M_2$  and  $M_3$  placed quite as in *Hydatopsyche melli*. *Male*: Tenth segment formed as in *H. frater* Ulmer, but longer; its basal portion, seen from above, is broad, triangular; distal portion elongated; its apical portion is divided by a median fissure into two portions, as in *H. frater*; before this apical portion is placed, above, a minute tooth. Lateral appendages of the tenth segment are long, directed upward, and very slender; they are rod-shaped, without hairs. Inferior appendages resembling those in *Hydatopsyche melli* Ulmer; basal joint very obliquely truncate at its apex, which is somewhat dilated; second joint rather slender, in its distal portion curved upward and inward. Penis thick and long, in structure somewhat similar to that of *Hydromanicus frater* and *Hydatopsyche melli*; its end portion is divided by a deep excision above into two side portions, which are broad, if seen from side, with rounded convex upper posterior margin; from the base of this end portion arise, below, two slender appendages, which are curved nearly in a knee-shaped manner, if seen from side; these processes are shorter than the upper lobes. Length of body, 6.6 mm.

*Remarks*.—In the structure of the tenth segment, and partly of the penis, this species is similar to *Hydromanicus frater* Ulmer, but in the structure of the inferior appendages, and of the lateral processes of the tenth segment, which are very long and slender, it reminds one more of *Hydatopsyche melli* Ulmer. In the anterior wings the subcosta is confluent apically with R, as in *melli*, but the short, common portion ends not on  $Rs_1$ , but on the anterior margin, close to  $Rs_1$ . Discoidal and median cells as in *Hydromanicus frater*, but the third fork begins earlier, and  $M_2$  and  $M_3$  are connected by a cross vein as in *Hydatopsyche melli*. Thus *intermedius* is really an intermediate form between these species, proving that the genus *Hydatopsyche* Ulmer is very closely allied to *Hydromanicus frater* Ulmer with its allies, and perhaps may be united with it.

*Type*.—Male, U.S.N.M. No. 43155, from between Mount Omei and Mount Wa, Szechwan (2,000 to 8,000 feet), 1922.

*Specimens examined*.—One, the type.

## HYDROMANICUS species

Specimen examined is without abdomen.

Head and thorax brown, with yellow hairs above; legs dark yellow, tibiae and tarsi somewhat darker. Anterior wings brown with minute pale spots or dots, clothed with yellow hairs. Venation similar to that in *Hydromanicus frater* Ulmer, but Sc and R are united at their ends and the short common portion, Sc+R, reaches the margin of wing near  $Rs_1$ .

*Specimens examined*.—One female, from Shin Kai Si, Szechwan, July 1–17, 1922.

## Family CALAMOCERATIDAE

## Genus ASOTOCERUS McLachlan

## ASOTOCERUS OCHRACEELLUS McLachlan

## PLATE 2, FIGURES 28 to 31

*Asotocerus ochraceellus* McLACHLAN, Trans. Ent. Soc. London, ser. 3, vol. 5, p. 255, pl. 17, fig. 2, pl. 19, fig 2, 1866.

*Description*.—Shape of wings and general coloration as in McLachlan's description; posterior wings apparently somewhat darker, grayish. Wing venation differs somewhat from that of McLachlan's Plate 19, Figure 2, but McLachlan's figure is not quite precise. Anterior wings long, narrow; discoidal cell long, narrow; median cell equal to it in length. In posterior wings first apical fork arises much basad of the second one; third apical fork long, with very short pedicel. *Male*: Tenth segment roof-shaped, elongated, with broadly excised or concave upper margin, if seen from the side; apical margin truncate. Preanal appendages oval, hairy. Inferior appendages very long and slender; their distal portions curved arcuately inward and very slender; second joint coalesced with the first and any boundary between them is not perceptible. Length of body, 8 to 8.5 mm.; expanse 28 to 32 mm.

*Remarks*.—This form probably belongs to *Asotocerus ochraceellus*. Dr. M. Mosely, of London, kindly compared one of the specimens with the type in the British Museum and informed me that the wing venation in our specimen is very similar to that in the specimen in the British Museum; but one should not forget that the genital appendages in this species are not described. A positive identification needs careful comparison of these structures.

*Asotocerus ochraceellus* is known from Borneo and Java.

*Specimens examined*.—One male from Trong, Lower Siam, January–February, 1899; two males from Khow Sai, Dow (10,000 feet), Trong, Lower Siam, January–February, 1899.

## Family LIMNOPHILIDAE

## Genus PSEUDOSTENOPHYLAX Martynov

PSEUDOSTENOPHYLAX FUMOSUS Martynov GRAHAMI, new subspecies

## PLATE 3, FIGURES 32 TO 37

*Description.*—Apical margin of anterior wings not so regularly rounded as in the typical form from Ordos, the apex being somewhat produced. Coloring of anterior wings is not diffuse; it can be described as brown, with numerous pale irrorations; sometimes dark reticulation is distinct only along the longitudinal veins, the median portions between two neighboring veins being pale.  $Rs_1$  arises from the discoidal cell a little earlier than in the typical form; the veins Cu, A, M, R, and both main branches of Rs slenderer and somewhat paler than in the typical form. Posterior wings as in the typical form; the areas between  $A_3$  and jugal vein (vena arcuata) clothed, in male, with numerous rounded scales, as in *Pseudostenophylax fumosus*.<sup>3</sup>

*Male:* Eighth segment as in typical form, but the posterior median portion of it bears numerous strong brownish hairs or spines, turned mostly downward; black spinules are disposed as usual. Preanal appendages pale, not projecting very much behind the ninth segment. Penis large, forming an angular projection backward, then suddenly bent to the body, truncate at its apex, if seen from above. Basal portions of titillators thick, pale, and erectile; distal portions chitinized, brownish, tuberculated, at their end each bearing a brush of long spines, directed outward and to the body.

*Female:* Females were unknown in the typical form. Anterior wings grayish brown, with numerous small, rounded, pale irrorations; shape of wings as in male; veins somewhat yellowish and a little more slender than in male. Scales on the posterior wings lacking. Abdomen brownish above, yellowish beneath.

Seventh sternite with a transverse chitinized projection. Upper side-pieces of the ninth tergite large, triangular, but rounded at their hind angles; their lower edges are almost straight; dorsal part of the ninth tergite is weak, narrow, and almost completely coalesced with the tenth segment. Ventral portion of the ninth segment forms a broad plate, gradually tapering to its hind margin, the outer angles of which are somewhat projected. Median lobe of the subgenital apparatus small, rounded, dark, side lobes almost twice as long, with obliquely truncated hind margins. Tenth seg-

<sup>3</sup> In Ann. Mus. Zool. Acad. Sci. St. Petersburg, vol. 14, pp. 281–287, 1909, vena arcuata is named  $A_6$ .

ment subdivided by the median fissure into two lateral portions, bearing hairs; their inner portions form two, nearly contiguous, slender processes, directed backward. Side portions of the tenth segment, seen from the side, form two subtriangular projections above the side pieces of the ninth segment; seen from beneath these projections prove to be curved inward, in the shape of two transverse narrow plates. Length of body, male, 11 to 12 mm.; female, 12.5 mm.

*Remarks.*—This form differs from *Pseudostenophylax fumosus* from Ordos<sup>4</sup> by the dense brush of spines on the eighth tergite, by the presence of but few hairs on the ninth segment, by Rs arising a little earlier, by much more distinct reticulation in the anterior wings, and by more slender and paler longitudinal veins. The shape of the inferior appendages is somewhat varying. Position of Rs<sub>1</sub> is also not quite constant, and there are some intermediate conditions.

The structure of female genital segments recalls those of *P. szechwanensis* Martynov.

*Type.*—Male, U.S.N.M. No. 43160, from Uen Chuan, Szechwan.

*Specimens examined.*—One male, from Mount Omei (5,000 to 11,000 feet), Szechwan, August 24–27, 1921; one male and one female, from Yellow Dragon Temple, near Songpan (11,000 to 14,000 feet), July 20–24, 1924; one male, from Uen Chuan, Szechwan, 1921.

**PSEUDOSTENOPHYLAX DIFFICILIS, new species**

PLATE 3, FIGURES 38 TO 42; PLATE 4, FIGURES 43, 44

*Description.*—Head yellowish anteriorly, yellowish brown above; vertex somewhat elevated, forming between the bases of antennae a rounded prominence with a third ocellus at its apex; hairs brownish, mixed with yellowish anteriorly. Antennae brown, with yellow annulations, basal joint yellow. Prothorax yellowish brown; mesonotum brown in the middle, almost black at its sides; coxae brownish, femora and tibiae yellow, the anterior and median ones with brownish spots; tarsi yellow, but the bases and ends of the joints, except the end of the fifth, are brownish; posterior tarsi yellow, somewhat brownish at their bases; last tarsal joint with a few spinules; spines black. Anterior wings obliquely rounded at their apical margin; apical portion comparatively large; ground color brown, irrorated with very numerous small rounded pale spots; veins yellowish. In the male C and R are very thick, in females more slender; discoidal

<sup>4</sup>In Ann. Mus. Zool. Acad. Sci. St. Petersburg, vol. 19, p. 267, 1914, *P. fumosus* is indicated from South Siberia. I would note here that this indication is erroneous and is based on an incorrect label. Both male specimens, mentioned there, were taken also in Ordos, by N. Przewalsky.

cell long, not dilated in its apical portion,  $Rs_1$  arising rather far from the end of it. Posterior wings comparatively feebly dilated in the anal region; membrane forming short prominences at the ends of  $A_1$ ,  $A_2$ ,  $A_3$ ; the hairs of anal region thin, yellowish; apical portion comparatively long, as in forewings, discoidal cell long, RS arising before its end, as in the anterior wings; membrane granulose. Abdomen yellowish brown above, paler beneath.

*Female*: Genital segments formed as in *Pseudostenophylax minor* Martynov, but with some differences. Eighth segment large, with dark concave hind side-margins in its ventral portion, as usual. Ninth segment as in *minor*, but not so high; its ventral portion (supragenital plate) broad, but short, tapering hindwards; hind portion subdivided by a short narrow excision posteriorly into two rounded lobes; seen from the side it appears as being rather square, pale. Tenth segment is subdivided by a triangular excision posteriorly into two lateral portions, each forming a short and very slender pale process, with apex turned somewhat upward; beneath these processes the hind margin of the tenth segment, viewed laterally, forms an oval prominence, separated by a deep excision from the upper processes. Median lobe of the subgenital plate small, capitate, narrow at its base; side lobes dark, larger, truncate at their inner posterior edges, similar to those in *minor*.

*Male*: Eighth segment large as usual, in its posterior portion clothed above with minute black spinules. Preanal appendages rather long, cylindrical, brownish above and bearing several long erect black hairs. Ninth segment with concave posterior lateral margins; the portions corresponding to the lateral lines of abdomen are very thin and pale on hind portions of the segment, thus subdividing the sides of the ninth segment into dorsal and ventral portions; the dorsal portion is subtriangular and clothed with long hairs. Inferior appendages form two very broad plates, truncate and somewhat concave at their hind margins; at their base they are somewhat narrower than at their ends; hind portions with long hairs. Tenth segment forms a large projection backward, by the narrow and deep median excision posteriorly subdivided into two side portions; each of these portions forms above a strong brown thickening, triangular if seen from side; seen from above these thickenings appear to be narrow distally, but broad in their proximal portions; the proximal edges obliquely truncate and black. Penis not exerted in our specimens; its hind portion is rounded and brown; titillators composed of two portions, as usual; distal portions are long, arcuate, but slender toward their base especially; their hind outer edges bear rows of short spines and spinules. Length of body, 11 to 12 mm.

*Remarks.*—The structure of the female genital segments proves that this is rather closely related to *P. minor* Martynov<sup>5</sup> from Kham, but distinct. Subgenital apparatus, supragenital plate, and the tenth segment are very much as in *minor*, but in this species the hind margins of the tenth segment do not form oval convexities below the apical processes, being invariably concave; the supragenital plate is also somewhat different. The male of *minor* unfortunately is unknown.

*Type.*—Male, U.S.N.M. No. 43159.

*Specimens examined.*—Two males and five females, from Yellow Dragon Temple, near Songpan (11,000 to 14,000 feet), July 20–28, 1924.

### Genus NOTOPSYCHE Banks

#### NOTOPSYCHE RHOMBIFERA, new species

#### PLATE 4, FIGURES 45, 46

*Description.*—*Male:* Head, mesothorax, and metathorax black, prothorax reddish yellow; legs blackish brown, with yellow hairs; spurs yellow. Palpi, both pairs, long, black; basal joint short, second and third long. Anterior wings brownish, with brownish veins; pterostigmal region darker. Venation as in *Notopsyche nigripes* Martynov; discoidal cell long; fourth apical cell limited by an erect (not oblique) cross vein at its base, and nearly equal in breadth to the second one; fifth cell acute at its base. In the posterior wings the discoidal cell is also long. Membrane granulose.

Eighth tergite with a long median projection; preanal appendages concealed in its interior, but apparently high, as in *nigripes*. Inferior appendages in the form of two large, rhomboidal plates, clothed with hairs. Penis thick, broad; titillators strongly thickened in their basal portions, then rod-shaped, with thickened apices; they are thicker than in *nigripes*. Length of body, 8 mm.; expanse, 23 to 24 mm.

*Remarks.*—This species is allied to *N. ruficollis* Ulmer, *N. nigripes* Martynov, and *N. intermedia* Martynov, from which it differs chiefly by longer inferior appendages and by thicker titillators.

*Type.*—Male, U.S.N.M. No. 43162.

*Specimens examined.*—Two males, from Suifu, Szechwan, November–December, 1923.

<sup>5</sup> Ann. Mus. Zool. Acad. Sci. St. Petersburg, vol. 14, p. 279, pl. 5, figs. 23–26, 1909 (*Allophylax* ? *minor* Martynov).

Genus **PLATYPHYLAX** McLachlan**PLATYPHYLAX** species

*Description*.—Head and thorax reddish brown, mesonotum dark reddish in the middle, brown at sides; legs yellow with black spines; abdomen brownish above, paler beneath; hind portion pale. Anterior wings brownish, irrorated with very small pale spots; apical margin parabolic; discoidal cell long; first, second, and third apical forks angulate at bases; apical cell closed at its base by an oblique vein. Hind wings also with long discoidal cell. Length of body, about 12 mm.

Genital segments (eighth, ninth, and tenth) formed as in *Platypylax rufescens* Martynov, from eastern Tibet, but they are not in good condition. At any rate, this form is closely allied to *rufescens*, but apparently distinct, differing by darker coloration of the head and thorax as well as by brownish anterior wings. Processes of the tenth segment apparently are somewhat thicker.

*Specimens examined*.—One female, from Yellow Dragon Temple, near Songpan (11,000 to 14,000 feet), July 25–28, 1924.

Genus **STENOPHYLAX** Kolenati**STENOPHYLAX** species

*Description*.—Head and thorax reddish yellow, abdomen reddish brown; legs yellow with black spines; spurs 1, 3, 4, yellow; antennae reddish yellow. Anterior wings pale brownish, irrorated with minute pale yellow spots; costal, subcostal, and postcostal areas pale yellowish; apical portion triangular, somewhat produced at  $Rs_4$ ; discoidal cell long, dilated at its end. The end of the abdomen in the female is formed somewhat like *Stenophylax permistus* McLachlan. Length of body, 13 mm.

*Remarks*.—This species represents, probably, a new species, but it is impossible to describe adequately the formation of its genital segments, as they are not in good condition.

*Specimens examined*.—One female, from Mount Omei (5,000 to 11,000 feet), Szechwan, August 24, 1927.

Family **SERICOSTOMATIDAE**Genus **EODINARTHURUM**, new genus

*Male*.—Basal joint of antenna thick, as long as the thorax, clothed with outstanding hairs and scales and, at least in the species here described, bearing two short processes. Basal joint of the maxil-



lary palpi in the male rather long, second joint approximately one-half as long, slender. Spurs 2, 4, 4, the inner ones a little longer than the outer ones. Anterior wings not very broad, resembling those of the genus *Dinarthrum* McLachlan, with similar venation, except the groove and apical veins; the groove along CuP is very deep, reaching the anastomosis and concealing M in its interior; discoidal cell long,  $Rs_4$  apparently detached at its base from  $Rs_{3+4}$  and approximated to the end of the groove; behind it there are four apical branches, connected at their bases by an oblique vein; these branches represent probably two branches of M, CuA<sub>1</sub>, and A<sub>1</sub>. The portion of the wing anterior to the groove is clothed with minute blackish scales; apical portion clothed with hairs. Hind wings as in *Dinarthrum*. Male genital appendages resembling those of the genus *Dinarthrum*, but the second joint of the inferior appendages is longer, basal joint provided with a slender basal appendage; median portion of the tenth segment not produced downward.

*Type species*.—*Eodinarthrum pusillum*, new species.

EODINARTHRUM PUSILLUM, new species

PLATE 4, FIGURES 47 TO 51

The specimen examined is in poor condition; the wings are damaged, and I could not make a figure of the hind one.

*Description*.—Head brownish; basal joint of antennae yellowish brown, somewhat thickened on its distal portion, bearing two processes on the inner side, one basal and one distal, clothed with numerous outstanding blackish hairs; basal portion of the joint bears, together with hairs, a few elongated scales; antennae approximately as long as the body, brownish, with indistinct yellow annulations in its basal part. Maxillary palpi brownish, and clothed with outstanding hairs. Thorax and abdomen brownish; legs brownish, clothed with minute yellowish hairs; spurs 2, 4, 4, long. Anterior wings brownish, clothed with yellowish hairs in their apical and hind portions; anterior portion, between the groove and costal vein, clothed with blackish scales; discoidal cell long; the groove deep, concealing in its interior the greatest portion of M and of Cu; CuA<sub>2</sub> is apparently lacking, as in many species of *Dinarthrum*. Posterior wings dark grayish. *Male*: Dorsal plate of the tenth segment similar to that of the genus *Dinarthrum*, but the median (double) portion is somewhat more produced backward; if seen from the side it is nearly triangular, without forming any dilation or prominence (downward) in its apical portion. Basal joint of the inferior appendages similar to that in the genus *Dinarthrum*, but from its base arises upward an additional slender process, as in

the genera *Crunaeciella*, *Lepidostoma*, and *Mellomyia*; basal segment clothed with long hairs, in its apical portion especially. Second joint of the inferior appendages in its shape similar to that of *Dinarthrum*, but more elongated, almost equaling half the length of the first joint. Distal portion of the penis directed downward, as in *Dinarthrum*; titillators very slender. Length of body, 4 mm. *Female*: Unknown.

*Remarks*.—In the shape of its anterior wings the present species is similar to the genus *Dinarthrum*, but differs from it in a much deeper groove, concealing a portion of M and of Cu and extending up to the anastomosis. The general conformation of this groove resembles also that in the genus *Mellomyia* Ulmer (China), but in the latter genus this groove appears to be still deeper and conceals also Rs, up to the anastomosis; the arrangement of the branches of M and of Cu and  $A_1$  in the genus *Mellomyia* is also somewhat different. The male genitalia in the genus *Mellomyia* are much more specialized than in our genus, though formed on a similar plan (except the absence of titillators). *Eodinarthrum pusillum* is doubtless related to the genus *Dinarthrum* McLachlan, but these relations are not close; in the structure of male genitalia, as well as in the wing venation, the genus *Dinarthrum* is more primitive than the genus *Eodinarthrum*.

The genus *Mellomyia* is also somewhat allied to *Eodinarthrum*, but is much more specialized; its relations to the last-named genus are more distant.

*Type*.—Male, U.S.N.M. No. 43158, from Yellow Dragon Temple, near Songpan (11,000 to 14,000 feet), July 17–20, 1924.

*Specimens examined*.—One, the type.

### Genus GOERA Leach

#### GOERA DIGITATA, new species

#### PLATE 4, FIGURES 52, 53

*Description*.—Head and thorax rufous-yellow, clothed with somewhat thickened rufous-yellowish hairs. Basal joint of antennae long, the remaining ones very short, yellowish; palpi clothed with rufous-yellow hairs. Legs yellowish. Anterior wings clothed with short golden-yellowish hairs along the veins mixed with brownish ones, on the costa, especially; third apical fork almost reaching the level of the discoidal cell; second fork impinging not far on it. *Male*: Sixth sternite with a transverse row of nine thick spines, the median being the longest. Ninth sternite with a very long process, triangular in its basal, narrow in its distal portion. Pre-anal appendages long, slender, hairy, straight. Basal joint of the

inferior appendages very broad, with concave hind edge, if seen from the side; second joint similar to that of *Goera fissa* Ulmer (Kwantung), but its upper rod-shaped process is longer than in that species, and by a rounded excision beneath it separated from the lower triangular prominence, as in *Goera squamifera* Martynov. Tenth segment forming, above, a narrow plate, soon dividing into two long and slender brown processes, acute at their ends. Penis long and apparently resembling that in *Goera squamifera* Martynov. Length of body, 6 mm.

*Remarks.*—Judged by the structure of the male genitalia this species appears to be allied more to *Goera squamifera* Martynov.

*Type.*—Male, U.S.N.M. No. 43157.

*Specimens examined.*—Four males, from Suifu, Szechwan, March–April.

#### EXPLANATION OF PLATES

##### PLATE 1

FIGURES 1, 2. *Rhyacophila sinensis*, new species, male. Apex of abdomen from above and from side.

3–7. *Glossosoma anale*, new species, male. 3, Anterior wing; 4–6, apex of abdomen from above, from side, and from beneath; 7, process of seventh sternite.

8–11. *Glossosoma caudatum*, new species, male. 8, Basal portion of anterior wing; 9–10, apex of abdomen from above and from beneath; 10a, process of seventh sternite; 11, apex of abdomen, from side.

12, 13. *Stenopsyche grahami*, new species, male. Apex of abdomen from above and from side; 13a, inferior appendages from beneath.

##### PLATE 2

FIGURES 14, 15. *Stenopsyche siamensis*, new species, male. Apex of abdomen from above and from side; 15a, upper portion of inferior appendages.

16–18. *Hydropsyche appendicularis*, new species, male. 16 and 18, Apex of abdomen from above and from side; 17, penis and inferior appendages from beneath.

19–21. *Hydropsyche penicillata*, new species, male. 19, 20, Apex of abdomen from side and from above; 20a, end of penis, from above; 21, penis and inferior appendages from beneath.

22–24. *Hydropsyche columnata*, new species, male. Apex of abdomen from side, from above, and from beneath (penis and inferior appendages).

25–27. *Hydromanicus intermedius*, new species, male. 25, Distal portion of the fore wing; 26, 27, apex of abdomen from side and from above.

28–31. *Asotocerus ochraceellus* McLachlan (?), male. 28, Venation of anterior and posterior wings; 29–31, apex of abdomen from side, from above, and from beneath.

## PLATE 3

FIGURES 32-37. *Pseudostenophylax fumosus* Martynov *grahami*, new subspecies. 32-34, Apex of male abdomen from above, from side, and from beneath; 35-37, apex of female abdomen from above, from side, and from beneath.

38-42. *Pseudostenophylax difficilis*, new species. 38, Venation of anterior wings; 39-41, apex of female abdomen from side, from above, and from beneath; 42, apex of male abdomen from side.

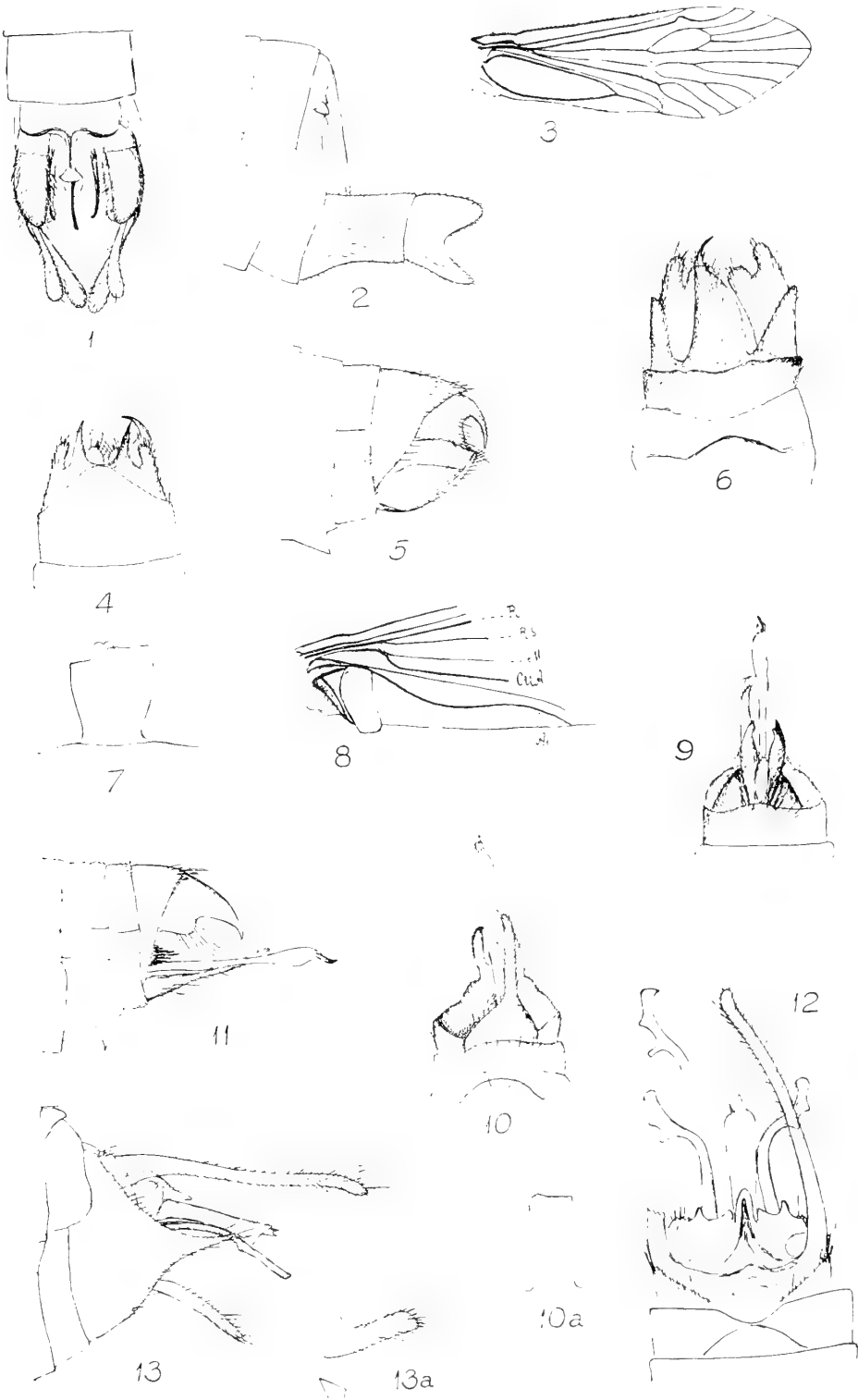
## PLATE 4

FIGURES 43, 44. *Pseudostenophylax difficilis*, new species. Apex of abdomen from above and from beneath.

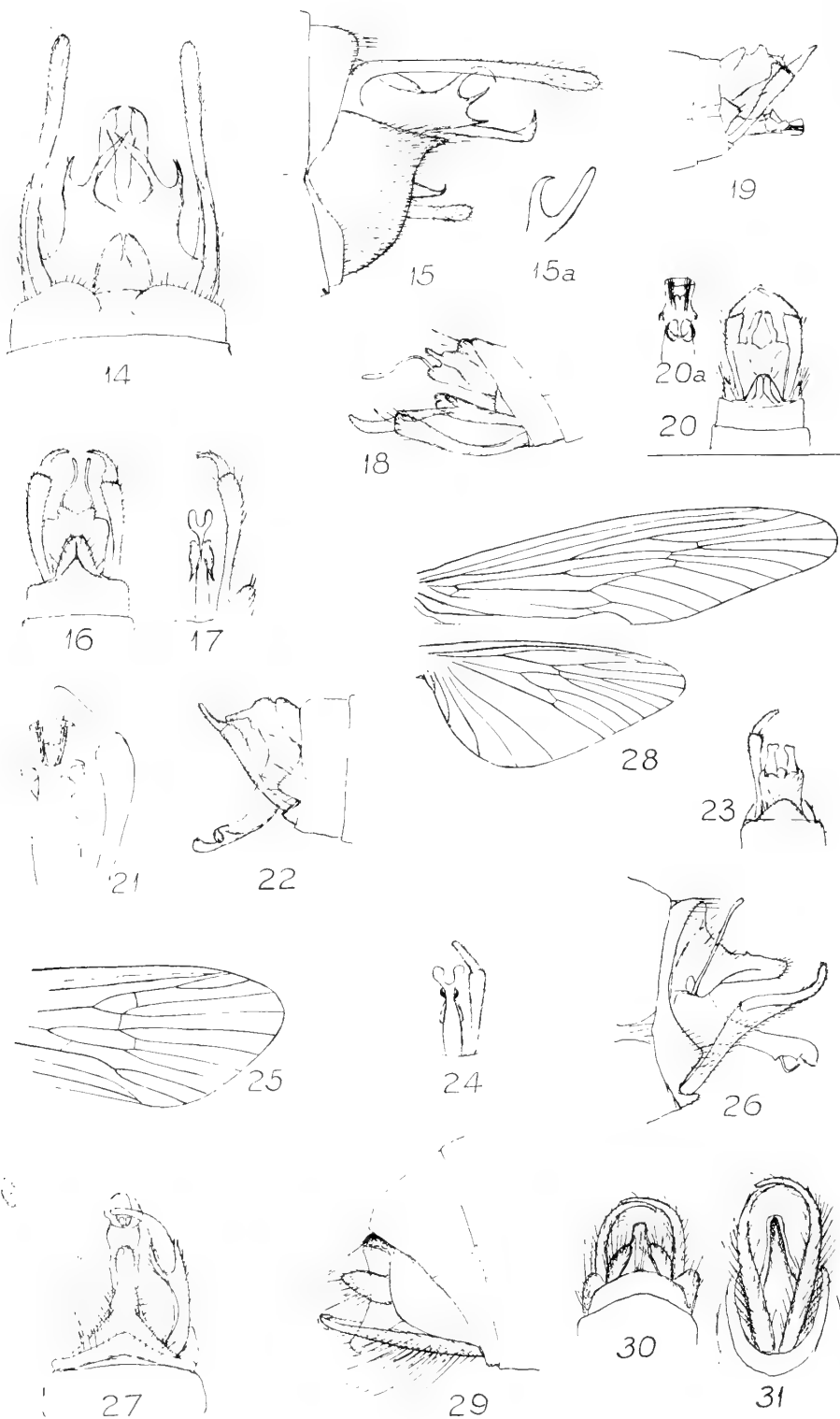
45, 46. *Notopsyche rhombifera*, new species, male. Apex of abdomen from side and from beneath.

47-51. *Eodinarthrum pusillum*, new genus and species, male. 47, Basal joint of antenna and maxillary palpus; 48, anterior wing; 49-51, apex of abdomen from side, from above, and from beneath.

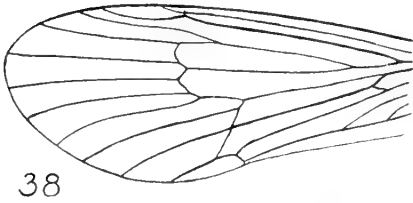
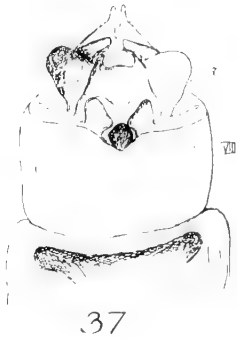
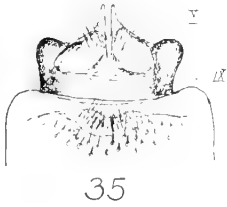
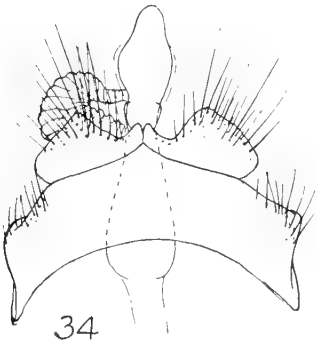
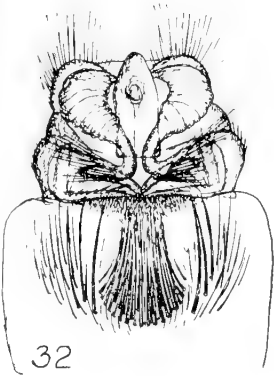
52, 53. *Goera digitata*, new species, male. Apex of abdomen from side and from beneath.

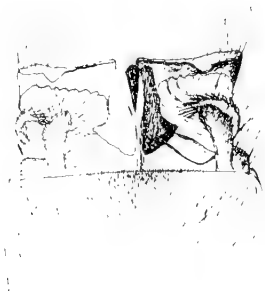


SPECIES OF RHYACOPHILA, GLOSSOSOMA, AND STENOPSYCHE  
FOR EXPLANATION OF PLATE SEE PAGE 19.



SPECIES OF STENOPSYCHE, HYDROPSYCHE, HYDROMANICUS, AND ASOTOCERUS  
FOR EXPLANATION OF PLATE SEE PAGE 19.





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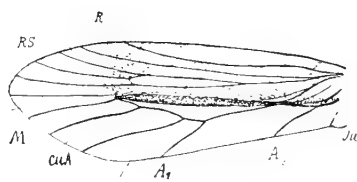
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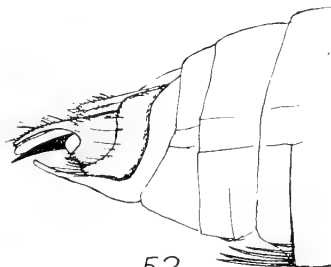
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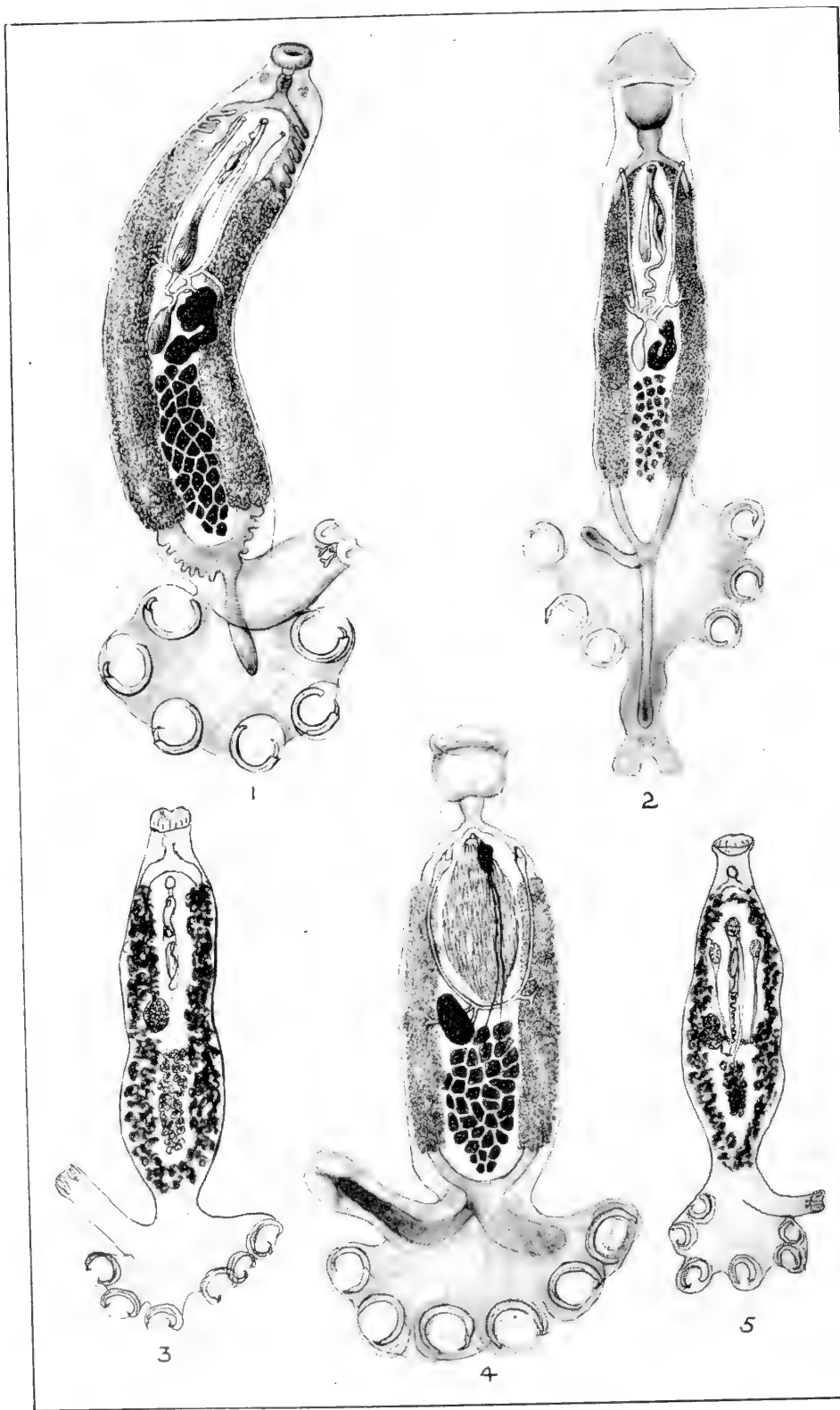
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SPECIES OF PSEUDOSTENOPHYLAX, NOTOPSYCHE, EODINARTHUR, AND GOERA

FOR EXPLANATION OF PLATE SEE PAGE 20.







## SQUALONCHOCOTYLE AND ACANTHONCHOCOTYLE

1, *Squalonchocotyle squali*, new species; 2, *S. sphyrnae*, new species; 3, *S. acanthi*, new species; 4, *S. vulgaris* Cerfontaine; 5, *Acanthonchocotyle musteli*, new species

# FOUR NEW SPECIES OF TREMATODE WORMS OF THE SUBFAMILY ONCHOCOTYLINAE

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## INTRODUCTION

For many years the differentiation of species among the Onchocotylinae has been in a state of great confusion. The name *Onchocotyle appendiculata* has been given indifferently to many different forms, and others have been set apart as distinct species without sufficient warrant. This, as usual, has resulted from the extremely incomplete study of the various worms found, and from the misinterpretation of organs and the neglect of characteristic features. Even now, although the anatomy of these forms has become fairly clear, their systematic arrangement is full of difficulties, because the meagerness of description makes comparison so nearly impossible.

The literature has been so well reviewed by Cerfontaine (1900) in his admirable paper that it is unnecessary to repeat it, and indeed his success in collecting practically all known forms for renewed study makes it impossible to do otherwise than accept his conclusions. Only one new form seems to have been described since his paper; namely, *O. somniosi* from *Somniosus microcephalus* (sleeper shark), by David Causey (1926).

Cerfontaine divides the subfamily Onchocotylinae into three genera: *Acanthonchocotyle*, *Squalonchocotyle*, and *Rajonchocotyle*. *Acanthonchocotyle* includes forms in which the penis is armed with spines; eggs with a single filament; parasites of Scyllidae. *Squalonchocotyle* includes forms with large mouth sucker; rectangular fixation disk without intestinal ramifications within it; vaginal orifices near the same level as the genital atrium, the two vaginal canals remaining separate to their union with the yolk duct; eggs with two polar filaments; parasites of Squalidae. *Rajonchocotyle* includes forms with small mouth sucker with transverse orifice, large round fixation disk with ramifications of the intestine within it; vaginal orifices behind the level of the atrium, the vaginal canals uniting in a single median canal; eggs without polar filaments and at most a small tubercle at one or both ends, and with meridional thickenings or ribs; parasites of the Rajidae.

Out of the confusion Cerfontaine rescues the worm first described by Kuhn from *Scyllium catulus* as *Onchocotyle appendiculata*, giving it the name *Acanthonchocotyle appendiculata*. This certainly has nothing to do with the form described by P. J. van Beneden (1858) as *O. appendiculata* from *Mustelus vulgaris*, nor with others described under that name. The other known species of the genus is *Acanthonchocotyle caniculi* Cerfontaine from *Scyllium canicula*.

ACANTHONCHOCOTYLE MUSTELI, new species

PLATE 1, FIGURE 5

*Specific diagnosis.*—*Acanthonchocotyle*: The present form, a very minute worm from the gills of *Mustelus canis*, must belong to this genus, but it does not agree with either of the two forms described by Cerfontaine, and we have therefore regarded it as a new species. In general form it agrees precisely with the generic description but differs in detail.

The body measures 2 mm. to 2.5 mm. in length by 0.5 mm. in breadth. The fixation disk is rather fan-shaped, the appendix starting up from its junction with the body. The large suckers are all about the same size. The form of the hooks (fig. 1, *c*) differs slightly from either of those shown by Cerfontaine (1900) in his Plate 19, Figures 5 and 6. The small hooklets are of moderately stout build (fig. 1, *c'*). The mouth sucker is not so wide as the body, but is thin walled and flares a little. The pharynx is small and compact and situated a short way behind it. The intestine is inconspicuous and does not visibly enter the fixation disk.

The penis is armed with about 60 minute spines, which take different positions according to its degree of evagination. The vaginal orifices appear at first sight to be armed with chitinous spines folded together in a bundle, but in one specimen the position is such that one can look into these orifices, and it is then found that there is a radiate chitinous margin with a starlike arrangement of wavy chitinous points about the central orifice. The wide vaginal canals run all the way back to join the vitelline duct (pl. 1, fig. 5). The ovary is much lobulated and situated at about the middle of the body. The uterus is a long straight tube without any coils or definite ootype. Testes form numerous small lobules with a wide, coiled vas deferens. The eggs measure  $176\mu$  by  $56\mu$ , and while the anterior pole is blunt, there is an extremely long, fine filament at the posterior end that coils far back in the uterus.

*A. musteli* is distinguished from other species of this genus by the form of the hooklets and hooks and by the chitinous armature of the vaginal orifices.

*Type specimen.*—U.S.N.M. Helm. Coll. No. 8131; paratypes No. 8132.

## SQUALONCHOCOTYLE SQUALI, new species

## PLATE 1, FIGURE 1

*Specific diagnosis.*—*Squalonchocotyle*: On the gills of *Squalus acanthias* (spiny dogfish) there were found several examples of this worm.

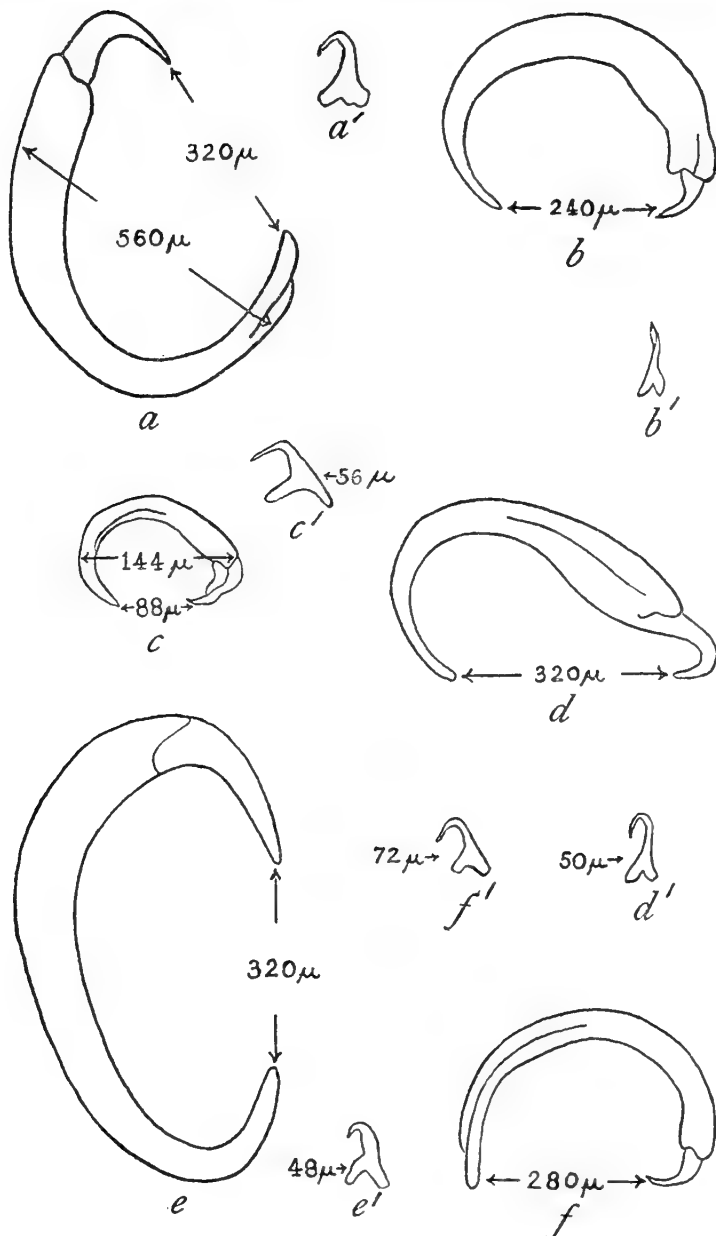


FIGURE 1.—Form of hooks of mouth suckers and small hooklets in appendix of: a, a' (respectively), *Squalonchocotyle canis*; b, b', *S. acanthi*; c, c', *Acanthonchocotyle musteli*; d, d', *Squalonchocotyle musteli*; e, e', *S. sphyrnac*; f, f' *S. squali*

Length, 7 to 10 mm.; breadth, about 1.5 mm. The mouth sucker is in the form of a small round knob with transverse slit, and narrower

than the anterior part of the body; pharynx small; intestines apparently much branched, though they are so completely covered by the vitellarium that they can not be plainly seen. A prolongation is sent into the fixation disk and into the appendix. Genital pore small and round, just behind the bifurcation of the intestinal ceca. Vaginal orifices a little posterior to this level, about halfway out to the margin of the body. Vaginae run back separately to the vitelline duct. Ovary much lobulated and folded. There is a large and conspicuous receptaculum seminis. Ootype fusiform, very thick-walled, and distinct, with eight longitudinal ribs formed by deeply stained cells. Uterus runs straight forward from this and contains one or two eggs, which are very large and thin-walled. They measure  $320\mu$  in length and  $120\mu$  in breadth, and have at each pole a short, stout, recurved filament about one-third as long as the egg. There are about 25 lobules of the testis in the midline behind the ovary. The cirrus is narrow and unarmed.

The hooks of the large suckers measure  $280\mu$  from tip to tip (fig. 1, *f*); the terminal hooklet is sharply marked off and is much narrower than the large portion. The other end shows a characteristic abrupt stoppage of one part of its whole thickness so that there is a projecting rounded end. The two small hooklets in the appendix are stout, with long recurved point and very blunt short branches at the base. They measure  $72\mu$  in length (fig. 1, *f'*).

The excretory system can be seen to open on the dorsal surface, far antero-laterally by an orifice on each side surrounded by a sharply outlined mass of cells.

It is difficult to fit this form into Cerfontaine's genera. It has a small rounded oval sucker with transverse slit, followed by a small pharynx. The genital organs are unarmed; there is an ootype with longitudinal ribs and faint longitudinal markings to correspond on the egg. But the egg, instead of ending in a small tubercle, has at each end a short recurved filament. Vaginal orifices are on a level with or slightly behind the genital atrium; the vaginae do not unite to form a single tube but run back separately to enter the yolk duct. The alimentary canal sends a prolongation into the fixation disk, but does not ramify there. And this has not been found as a parasite of one of the Rajidae. It agrees, therefore, with *Rajonchocotyle* in the form of its mouth sucker, ootype, and general conformation, but does not uphold the statement about the union of the vaginae, the lack of filaments on the egg, or the habitat. On the other hand, it differs from *Squalonchocotyle* in the form of the mouth sucker, but agrees in other respects. It is probably best to class it with the latter genus, temporarily at any rate, although it seems that the three genera may have been based on characters not strictly separated in all the forms.

On attempting to compare it with the other forms described, we find that this worm differs in some respects from all. It is much smaller than *S. borealis*, which measures 20 mm. in length, and has not the large open mouth sucker shown in that species. It is closer to *S. vulgaris*, except that that species also has a large bell-shaped mouth sucker, vaginal orifices near the margin of the body, and eggs measuring  $200\mu$  in length with straight prolongations. In other respects it resembles this form, but has no tubercles in the cuticle about the orifice of the mouth sucker. It differs from *S. canis* in that the eggs of that form have two very long, fine filaments, and this too applies to *S. abbreviata*. From *S. grisea*, too, it differs, especially in the size of the eggs, which are there only  $175\mu$  long, while in the present form they measure  $320\mu$  by  $120\mu$ .

It seems necessary therefore to separate this as a new species, *S. squali*, with the following characteristics: Parasite of gills of *Squalus acanthias*; 7 to 10 mm. in length; small mouth sucker; simple intestinal prolongation in fixation disk; vaginae separate to vitelline duct; ribbed ootype; eggs with recurved filament at each end.

*Type specimen*.—U.S.N.M. Helm. Coll. No. 8133; paratypes, No. 8134.

SQUALONCHOCOTYLE ACANTHI, new species

PLATE 1, FIGURE 3

*Specific diagnosis*.—*Squalonchocotyle*: This form, also found on the gills of *Squalus acanthias*, differs from *S. squali* in several particulars although resembling it in some. It measures 5 mm. in length by 0.8 mm. in breadth. The mouth sucker is small with no flowing margin, the pharynx small, and the intestinal ceca simple with a simple prolongation into the disk. The sucker hooks measure  $240\mu$  from tip to tip (fig. 1, *b*). The small hooklets in the appendix (fig. 1, *b'*) are very narrow and delicate, with long, sharply recurved points, and are quite different, therefore, from those of *S. squali*.

In the available specimens it is impossible to make out the position of the vaginal orifices or the course of the vaginae. The ovary is small and round, without lobulation. The uterus is thin-walled and straight without any distinct ootype. Two eggs were found in one specimen, and these measured  $304\mu$  by  $96\mu$  and may be seen to have a short recurved filament at each end. The genital opening is unarmed and lies just behind the bifurcation of the intestine.

The peculiar characters of this form are summarized as follows: Parasite on gills of *Squalus acanthias*; measurements, 5 mm. by 0.8 mm.; small mouth sucker; uterus without ribbed ootype; hooklets in appendix extremely narrow.

*Type specimen*.—U.S.N.M. Helm. Coll. No. 8135.

## SQUALONCHOCOTYLE SPHYRNAE, new species

## PLATE 1, FIGURE 2

*Specific diagnosis.*—*Squalonchocotyle*: Three specimens of a worm from the gills of *Sphyrna zygaena* (hammerhead shark) show a very different body form from these already described and also differences in several details of body structure. The mouth is very large and sunken in the depth of a large, weak sucker with flowing folded margins, which project a little laterally. It communicates at the bottom of this terminal funnel-shaped structure, which can best be appreciated from the drawing, with a small pharynx. The body, which measures 8 mm. by 0.5 mm., differs from the others in that the appendix, instead of arising at right angles from the main trunk, is merely a prolongation of the fixation disk. This is not an accident of fixation, for it appears plainly in each specimen, and there is a long projection of the intestinal canal, which runs through the fixation disk to enter the appendix, while the shorter branch turns forward to enter the fixation disk and end between two of the suckers. These large suckers have the usual form and their hooks measure  $320\mu$  from tip to tip (fig. 1, *e*). The hooks are unusual in that their points, which bend almost at right angles, are not so sharply marked off from the trunk as in other forms. In the appendix the hooklets are short ( $48\mu$ ) and broadly bifurcated (fig. 1, *e'*). There has been discussion as to the nature of this appendix. Van Beneden thought the excretory ducts opened through the tips of the two branches, and there have been other ideas, but it is quite plain that the appendix branches at its extremity, the branches ending in rather powerful deep suckers, which with the intervening hooklets form a sufficiently strong clinging apparatus. The suckers have no relation with excretory or digestive apparatus. They have a deep conical cavity ending in a circular muscular dilatation.

The genital pore is small, round, and unarmed, and lies in the midline, just behind the bifurcation of the intestine. The two vaginal orifices lie just outside the intestinal ceca at this level. The vaginae are very wide, the orifices have a thick hyaline border, which is then surrounded by a band of cells. The uterus runs a straight course but is drawn into short folds. There are six or seven eggs in the uterus. They are large, measuring  $200\mu$  by  $50\mu$ , with filaments at both ends, which are rather stout and about as long as the egg. There is a long, thick-walled, club-shaped cirrus, which lies dorsal to the uterus and opens with it at the genital pore. It is quite sharply marked off from the long, folded vas deferens. The ovary, which is in the middle of the body, is elongated and folded on itself, and there is a thick-walled receptaculum seminis. The testes lie behind the ovary in about 50 small lobules.



The peculiar characters may be summarized as follows: Parasites on gills of *Sphyrna zygaena*; measurements, 8 mm. by 0.5 mm.; appendix as prolongation of fixation disk; intestinal projection in both disk and appendix; hooks smooth, bent at right angle; eggs with stout filament at each end; thick-walled cirrus.

*Type specimen*.—U.S.N.M. Helm. Coll. No. 8136; paratypes No. 8137.

**SQUALONCHOCOTYLE VULGARIS** Cerfontaine

PLATE 1, FIGURE 4

This worm, found on the gills of the dusky shark (*Carcharinus milberti*), measures about 5 mm. by 1.5 mm. It is apparently the same as that described by Cerfontaine as found on the gills of *Mustelus vulgaris*, although he mentions its length as 12 mm.

The mouth sucker is large and strong and surrounded by a bell-shaped fold of skin, which is covered with great numbers of minute tubercles, or nodules. Even the edge of the sucker itself is roughened with them. About the esophagus and pharynx there are masses of cells that may act as a salivary gland or even produce a hirudin-like substance. There is a small pharynx, and the intestines, which are filled with a black pigment, are branched on inner and outer surfaces. The pigmented prolongations after the union of the ceca run down into the appendix and the fixation disk.

The hooks of the large suckers measure  $320\mu$  from tip to tip (fig. 1, *d*). The lips of the sucker are edged with tiny teeth and these too, or small tubercles, are scattered over the lining. The small hooklets in the appendix measure about  $50\mu$  in length (fig. 1, *d'*).

The genital pore lies just behind the bifurcation of the intestine. The penis is a pear-shaped mass covered over with minute, red-stained eminences, which seem to be cells and certainly not a chitinous armature. The uterus in every case is enormously distended with a mass of eggs, usually more than a hundred, so that it occupies the whole central part of the body. The eggs are spindle-shaped and measure  $200\mu$  by  $56\mu$ . They have a straight filament at each end about as long as the egg. The vaginal orifices are not, as described by Cerfontaine in his *S. vulgaris*, situated far toward the margin of the body, but lie inside the bend of the intestinal ceca. The vaginae run separately to join the vitelline duct. The ovary is large, lobulated, and folded. One can not see a receptaculum seminis on account of the crowding of the overfilled uterus, but it is described by Cerfontaine. There are about 20 testes in the middle of the body.

*Specimens examined*.—U. S. N. M. Helm. Coll. No. 8183.

**SQUALONCHOCOTYLE CANIS** Cerfontaine

Parasites apparently identical with those named *S. canis* by Cerfontaine, and found by him on the gills of *Galeus canis*, were found on the gills of *Carcharinus limbatus*.

The worm measures 5 mm. by 2 mm. The mouth sucker is large, with its margin projected forward in the middle and at each side. It is lined with minute teeth, or spicules. The pharynx is small and opens into the intestinal ceca, which are conspicuous from being filled with black pigment, which extends into the branches in the appendix and the fixation disk.

The genital pore lies just behind the bifurcation of the intestine. The uterus contains 8 or 10 eggs, which are fusiform and measure  $144\mu$  by  $48\mu$ . They have a long fine filament at each end. The penis is long and cylindrical and undulates to the point where it connects with a thick-walled seminal vesicle, which in turn receives the vas deferens. The testis forms a finely lobulated mass in the posterior part of the body.

The vaginal orifices lie at the level of the genital orifice, just inside the bend of the intestinal ceca. The vaginae are broad, convoluted, and run back separately to the vitelline duct. There is a rather distinct ootype, although the anterior part of the uterus is so greatly distended. The ovary is lobulated and folded on itself, and there is a large receptaculum seminis filled with spermatozoa.

The suckers of the fixation disk are very large; the hooks measure  $320\mu$  from tip to tip and  $560\mu$  over all (fig. 1, *a*). The whole lining shows a fine roughening with tiny spicules. The small hooklets have a broad base with very slight depression between the two rootlets and with a bend or elbow in the shank of the hook (fig. 1, *a'*). This is not quite so marked in these specimens as Cerfontaine described it, but it is quite visible. Nor are the large hooks of the suckers smaller in these specimens than in *S. vulgaris*—indeed these are the largest we have encountered. Still the agreement seems so close that we have little hesitation in believing that this is really *S. canis*.

*Specimens examined*.—U. S. N. M. Helm. Coll. No. 8139–8140.

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# SOME NEW MIDDLE CAMBRIAN FOSSILS FROM BRITISH COLUMBIA

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The Middle Cambrian faunas of British Columbia, particularly the marvelous assemblage of organisms from the Burgess Pass, discovered by Dr. Charles D. Walcott in 1910 and studied by him throughout the remainder of his life, continue to afford most interesting subjects for research. A small group of these fossils from the Burgess shale and the Stephen formation was sent me some time ago by the authorities of the United States National Museum for further study. In their general appearance they suggest graptolites, and as such had been laid aside for future study by Doctor Walcott. Upon close study, however, they have proved to be an unusually interesting and at the same time difficult assemblage of fossils, none of which belong to true graptolites. It is with the full realization of the tentative nature of the determinations that the following results of my studies are published.

## ALGAE

### DICTYOPHYCUS GRACILIS, new genus and species

#### PLATES 1, 2

This form consists of a reticulate network of delicate fibers, which, looked at with the naked eye, strongly suggests *Dictyonema*. With the aid of a microscope, however, the organism is seen to have no trace of thecae or of any other graptolitic structure except a number of irregularly distributed circular pores, the occurrence of which may or may not be accidental. The fibers themselves lack the strong consistence and glossy appearance that the chitinous tests of graptolites, as a rule, possess and suggest rather the softer tissue of plant life.

A study of the changes that take place in recent algae when decay sets in reveals the fact that in a form such as *Chlorodictyon foliosum* J. G. Agardh, one of the Caulerpaceae, the originally flat, broad, leaf-like expansions of the thallus become so perforated by the decay

of the interstitial tissue that the remaining portion is left as a network of fibers. The same thing happens in algae like *Dictyoneuron californicum* Ruprecht, whose broad leaf-like thallus bodies, provided with a reticulate system of strengthening ribs, upon decay form reticulate masses of fibers. Dr. H. D. House, State botanist of New York, informs me that such algal remains are very common along seashores.

It would be quite possible to refer this form to either *Chlorodictyon* or *Dictyoneuron* if it were not for the fact that one of the specimens retains a broadly oval, brownish, carbonaceous film within the network of fibers, making it probable that the form had a continuous thallus expansion, a feature that would distinguish it from either genus. (See pl. 2, fig. 3.)

*Description.*—Thallus oval to broadly flabelliform—attaining in the largest specimen, not wholly preserved, a width of 5 cm. and a height of 4 cm.—strengthened by a close network of supporting ribs or fibers, which, as a rule, are the only parts preserved. These fibers are for the most part entirely smooth and range in width from 0.25 mm. to 0.5 mm. In some portions pores are present, which, since they lack a regular arrangement and are the same size as the grains of the rock, are probably not a part of the organic structure but are merely due to the rock texture. The arrangement of the fibers varies from very irregular meshes in some portions to quite regularly rectangular meshes in others.

Since the bases of all specimens are broken, no rhizoids have been observed; nor has anything suggesting sporangia been seen.

*Occurrence.*—Middle Cambrian, Burgess shale (Loc. 35K), Burgess Pass, near Field, British Columbia.

*Holotype and paratypes.*—U.S.N.M. No. 83483.

*Remarks.*—Although we have compared the organism here described with *Chlorodictyon*, one of the Caulerpacae, and with *Dictyoneuron*, one of the Laminariaceae, no definite characters that would permit one to refer the fossil to either of the two families have been noted. We consider it probable, however, that if the fossil is an alga it must belong to one of these two families, which are so prominent in the marine flora of to-day.

H. DROZOA

CHAUNOGRAPTUS SCANDENS, new species

PLATE 2, FIGURES 4 TO 6; PLATE 3, FIGURE 3; PLATE 4, FIGURE 1

Grouped about a specimen of the sponge *Tupoa lineata* Walcott are some rhabdosomes of a "graptolite" that quite obviously used the

sponge to climb upon. Since one specimen of this graptolite has both sides preserved, it is referred on the basis of its habitus to *Chaunograptus*.

*Description*.—Rhabdosomes consisting of slender (0.12 mm. wide), straight stems (hydrocaulus 25 mm. long), which branch either very infrequently or only near the base. Thecae short, conical, narrowing distinctly toward base (projecting portion 0.7 mm. long), alternating on the hydrocaulus and projecting irregularly at various angles ranging from 90° to 20°; though most often at right angles they are at times sharply curved upward. Aperture circular, slightly expanded. Periderm apparently smooth. Gonothecae not distinguished.

*Occurrence*.—Middle Cambrian, Burgess shale (Loc. 35K), Burgess Pass, near Field, British Columbia.

*Holotype and paratypes*.—U.S.N.M. No. 83484.

*Remarks*.—This species resembles *C. novellus* Hall, the genotype, more than any of the other species referred to the genus. (Ruedemann, 1908, p. 223.) Though all the species are repent upon foreign bodies, *C. scandens* seems not to have been so closely attached as the others.

In the description of the graptolite *Mastigograptus* (1908, p. 213) I pointed out the fact that it was closer to the hydrozoans in the character of its thecae than any other form. Later (1919) Chapman described two species (*Archaeolafoëa longicornis* and *Archaeocryptolaria skeatsi*) from the Ordovician of Australia, which, on the basis of the form of the hydrothecae and the discovery of the gonothecae attached to the hydrosome, in at least the first of the two, he unhesitatingly referred to the hydroid coelenterates of the order Calyptoblastea and the family Lafoëidae. He likewise placed *Mastigograptus* Ruedemann in the same order and family, and pointed out that *Chaunograptus* also approaches his forms so closely that it is referable to the same group.

In the basal constriction of the thecae and the irregular angles of divergence of the thecae from the hydrocaulus the new species of *Chaunograptus*, even more than those previously described, suggests relationship to the hydroids of the campanularid type. It differs sharply in this respect from the true graptolites, the Dendroidea and Graptoloidea, which according to evidence now accumulating belong to an entirely different phylum.

The fragments reproduced in Plate 2, Figures 4 and 5, indicate the presence in the Burgess shale of a hydroid larger than *Chaunograptus scandens*. The fossil is, however, too fragmentary to warrant a description.

## CRUSTACEA

MARRIA WALCOTTI, new genus and species

PLATE 4, FIGURES 2, 3; PLATE 5

Two specimens (from the famous fossil bed on Mount Stephen, Loc. 14s), when seen with the naked eye are amazingly suggestive of a graptolite such as *Nemagraptus gracilis*. They were laid aside by Doctor Walcott with the other supposedly Cambrian graptolites. After the study of these two specimens on which the following description and discussion are based, further search yielded five more incomplete ones, most of which had been regarded as fragments of the sponge *Pirania muricata* Walcott.<sup>1</sup>

When the specimen selected as the holotype was studied under the microscope it lost its graptolitic aspect and revealed itself as the segmented body of a crustacean with large regularly jointed arms, each joint of which gives rise to a side branch. In other words, it is a bizarre crustacean, its immense swimming feet serving to distinguish it from all other Cambrian crustacean genera.

Inasmuch as *Marrella* may become a synonym, if my subsequent contentions are sustained, and thus nullify the compliment that Doctor Walcott wished to pay his friend Prof. John E. Marr, of St. Johns College, Cambridge University, I am calling this new crustacean *Marria* in order to perpetuate the compliment.

*Description*.—Body small (7.5 mm. long and 3.5 mm. wide in compressed condition), elliptical in outline, with truncated front. Carapace of head (or cephalothorax?) of subquadrangular outline (about 3.25 mm. long and 3.5 mm. wide) occupying half of the body. Postcephalic portion (either thorax + abdomen or abdomen only) consisting of seven (or possibly eight) simple segments, the first of which is 0.7 mm. long, the others decreasing slightly in length as well as regularly in width. There is no trace of a telson or of caudal styles. The frontal portion of the supposed head possesses a subtriangular depression, the base of which is in front. Near the apex is a small tubercle with a central depression, strongly suggesting the presence of an eye. Since the surfaces of the head and segments show no sculpture, they were apparently smooth. On the head, to the left and right and behind the eye, are several irregular nodes, which may be incidental to the preservation. There is also a pair of black spots or minute tubercles on either side of the eye. A distinct tubular depression, suggesting the alimentary canal, begins behind the eye, where it is somewhat wider, and extends backward to the first segment.

The most important feature of this organism is the presence of the two pairs of immense swimming appendages, both of which

<sup>1</sup> Walcott, C. D., Smithsonian Misc. Coll., vol. 67, p. 298, pl. 79, fig. 1, 1920.

proceed from the anterolateral corners of the head. Both are fundamentally biramous, dividing into two principal branches, which in turn send out a series of secondary, filamentous branches bearing setae on one side. The first pair, which is the shorter, is directed forward, the second sideways. Only one of the first pair (on the right side) of swimming appendages is preserved. The protopodite is short and stocky. One of the branches (exopodite) has only the base preserved; the other branch (endopodite) bears four or five (one displaced) long, flexuous, secondary branches and shows the base of a fifth or sixth. The series of secondary branches on the exopodite from the four bases shown on the stump in front of the head, as drawn in the restoration (pl. 5), are conjectural. We can not determine whether this first pair of appendages represents the first pair of antennae or the second; if the latter, the first pair of antennae may have been small or very tenuous.

The second pair of swimming appendages is by far the larger of the two and may either represent the second pair of antennae or may correspond to the mandibular foot of the nauplius. (See under Relationships.) The protopodite is again short and powerful and appears to consist of two joints. The forward division of the foot, which we take to be the exopodite, is extended horizontally and reaches a length of 20 mm.; the number of its joints can not be definitely established. On one side it bears 7 to 11 thin flexuous sub-branches (exites) and on the other about 6, which branch off nearer the base. The posterior division of the swimming foot, according to our view the endopodite, curves backward nearly parallel to the body, giving off about 10 slender, thin endites, about 14 mm. long, on the outer side of the branch, and terminates in a similar but shorter (9.5 mm.) endite.

All the exites and endites are provided with short setae on one side. These, however, may be only the bases of longer bristles, since there is one fragment that retains long stiff setae on the portion of the swimming appendage preserved.

On the left side are three simple legs, two of which undoubtedly proceed from the underside of the head, and the third (not drawn on restoration) appears to do so. On the right side are the bases of what appear to have been abdominal feet, the stumpy second, however, being doubtful. There is no evidence of a biramous structure or of gills, the exopodites apparently alone protruding beyond the body.

*Occurrence.*—Middle Cambrian, Stephen formation (Loc. 14s), Mount Stephen, British Columbia.

*Holotype and paratypes.*—U.S.N.M. No. 83485.

*Relationships of Marria.*—There is no fossil crustacean that can be directly compared with *Marria walcotti*. The only fossil form that

to our knowledge in a general way resembles it is the grotesque *Bostrichopus antiquus* Goldfuss of the lower Carboniferous (Culm.) of Nassau, Germany. (See fig. 1.) The one specimen known to have been found is preserved in the Bonn collection. Good figures are given in part 1 of Roemer's *Lethaea geognostica* (1876), pl. 38, figs. 10a-b, and recently (1929) Steinmann has redescribed it, giving a restoration. According to Goldfuss's figure this minute crustacean is surrounded by a corona of 60 extremely thin, flexuous, filamentous appendages, radiating from three (or four?) short basic appendages, located behind the head. Steinmann reconstructs the form as having the filamentous feet distributed evenly in pairs on the segments of the body and concludes that the species belongs to an entirely extinct class of crustaceans. Even though the swimming feet have a similar structure, our species is still different in the form of the body, especially of the head, which bears two large eyes in *Bostrichopus*.

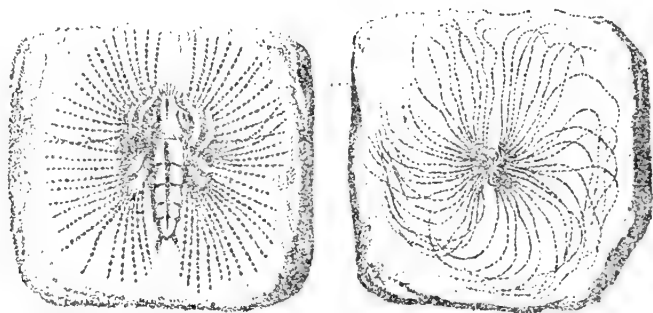


FIGURE 1.—*Bostrichopus antiquus* Goldfuss. Right figure, entire specimen, natural size; left, enlargement of body and bases of limbs. (After Roemer)

The outstanding characters of *Marria* are the very simple body and the enormous development of the antennae (see *postea*), which indicates an extreme adaptation of an otherwise primitive form.

The great age of the form and the fact that a similar development of the antennae (at least of the second pair) takes place in at least two orders of the Branchiopoda, namely, the Phyllopoda and the Cladocera, as well as in the next order, the Copepoda, make it probable a priori that the species represents a generalized type, not directly referable to any of the recent orders of crustaceans. Positive determination of its relationship is prevented by the fact that the mandibles and maxillae remain unknown and that the subdivisions of the body can not be definitely made out. How uncertain are the determinations of Cambrian crustaceans from incomplete remains is clearly evidenced by the fact that Walcott's determinations of the Burgess shale crustaceans were challenged by Fedotov (1925) and Fedotov's in turn by Henricksen (1928).



Other important characters of *Marria* are the immense development of two swimming arms (first and second pair of antennae, see *postea*), the large unsegmented head with carapace (possibly cephalothorax) bearing a single eye, five pairs (or less) of legs, a simple abdomen, consisting of about seven segments, and the absence of a telson.

It is customary to refer the earlier Paleozoic crustaceans to the suborder Phyllopoda of the order Branchiopoda, because these are the oldest and most primitive crustaceans. [The recent genus *Apus*, or *Lepidurus*, has been traced to the Permian (Ruedemann, 1922).] There is indeed a close resemblance to the family Limnadiidae of the Phyllopoda—particularly to *Limnetis* in the biramous, strongly developed second antennae, the single (not bivalved) carapace, the fused compound eyes in the middle of the head, and the small number of thoracic feet. Although a telson is present in *Limnetis*, in *L. brachyura* it is so small that this species appears but little different from our specimens in this respect. The body of the Limnadiidae is, however, laterally compressed and the carapace covers most of it.

According to common consensus of opinion the Limnadiidae lean toward the second suborder of the Branchiopoda, the Cladocera. *Marria* also has important characters in common with Cladocera, namely, the strong development of the biramous second antennae into principal organs of locomotion, the fused compound eyes, and the short body with a small number of thoracic limbs. Though the Cladocera have a telson, it is variable in size and in some species much reduced. The carapace is likewise variable, for while it is most frequently a bivalve shell inclosing the whole postcephalic region of the body, it may be reduced to a mere brood pouch, as in Leptodora. The segmentation of the body is little pronounced, if not obscure, the thorax bearing as many pairs of limbs as there are segments; the abdomen having but three segments, bearing no limbs, but with a telson. The head in the Cladocera, however, is always bent downward so that the first pair of antennae and the median eye are on the ventral side.

It will be seen that our form, though not directly referable to the Cladocera, agrees well with that order in the development of the second antennae, the carapace (aside from its common bivalve form in the Cladocera), the fused eyes, the small number of segments, and thoracic limbs. It would seem to differ in not possessing the downward bend of the head or a telson.

Our species also invites comparison with the second order of crustaceans, the Copepoda, in regard to the possible retention of the single nauplius eye, the strongly developed biramous second pair of antennae, and the possible absence of a carapace. The Copepoda

differ from *Marria* in having five pairs of biramous feet, the first of which is attached to the cephalothorax and the others to the thoracic somites. On the other hand, the strong development of plumed hairs in the pelagic forms may well be duplicated in *Marria*. Some of the members of the family Peltiidae of the suborder Podoplea have even flattened bodies, somewhat like isopods and probably *Marria*.

Finally, the close resemblance of our form to the nauplius of many crustaceans, among them even the Cirripedia and Malaco-

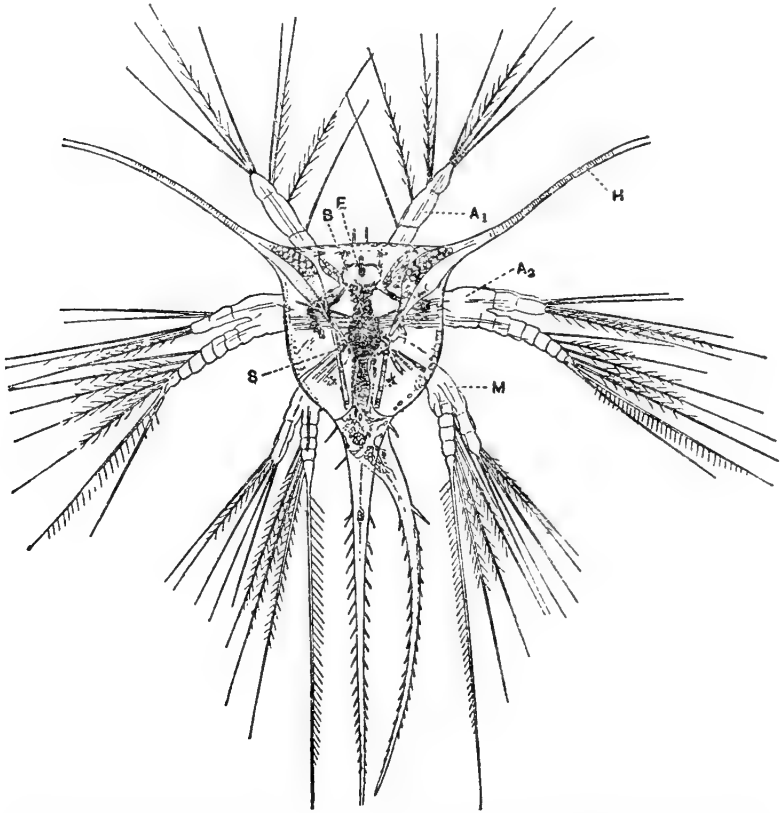


FIGURE 2.—Nauplius larva of *Lepas fascicularis*,  $\times 10$ . A<sub>1</sub>, A<sub>2</sub>, First and second antennae; B, brain; E, eye; H, frontolateral horn; M, mandible; S, stomach. (After Groom)

straca, is undoubtedly most striking. These bear not only a single eye but also two pairs of large biramous swimming legs, formed by the second pair of antennae and the mandibles. These biramous limbs, as, for example, in the nauplius of *Lepas* (see fig. 2), bear a large number of long spines, which in turn are set with stiff setae, the whole producing an organ strangely resembling that of *Marria* in which the spines are further developed into jointed secondary branches (endites and exites). As we can not be certain that the two pairs of swimming limbs of *Marria* represent the first and

second pairs of antennae, it is possible to assume that they may be the second antennae and mandibles and that we see in the nauplius, and still more so in the following protozocean larva of the Eucarida, a recapitulation of an ancestral *Marria*. We can visualize our species making its way through the water in a jerky or saltatory and more or less irregular manner, like most of the crustaceans that have large biramous swimming legs and short bodies.

As none of the crustaceans here used for comparison, except the nauplius and protozocean stages of later crustaceans, possesses a like development of the two large biramous swimming limbs, it appears necessary to consider *Marria* not only as a member of a new family, the Marriocaridae, but even of a distinct suborder of the Entomostraca, the Marriocarida.

MARRELLA SPLENDENS Walcott

PLATE 3, FIGURES 1, 2; PLATES 6, 7

*Marrella splendens* WALCOTT, Smithsonian Misc. Coll., vol. 57, p. 193, pls. 25, 26, 1912.

*Marrella splendens* RAYMOND, Mem. Connecticut Acad. Sci., vol. 7, p. 155, fig. 32, 1920.

*Marrella splendens* WALCOTT, Smithsonian Misc. Coll., vol. 67, no. 4, p. 170, 1921.

By far the most striking and bizarre crustacean discovered by Walcott in the Burgess shale is *Marrella splendens*. In contrast to its small carapace are its two pairs of massive curved hornlike appendages, the anterior pair of which projects sideways, and the posterior pair is directed backward. Walcott placed this form with the trilobites in a separate family of an unknown order, stating (1912, p. 192) that this family (Marrellidae) "is less primitive than the Apodidae and may be considered as near the Trilobita." This determination has been challenged by some of the authors who have discussed the crustaceans of the Burgess shale. Raymond (1920, pp. 115-117) states: "None of the illustrations so far published shows biramous appendages on the cephalon. This, coupled with the presence of tactile antennae, makes its reference to the Trilobita impossible, but the present interpretation indicates that it was closely allied to them." Raymond places *Marrella* with the Isopoda and gives a restoration of the ventral side (fig. 32, p. 116), showing two similar pairs of antennae (antennules and antennae) and three pairs of simple legs (the mandibles, first and second maxillae) on the cephalon. Another authority, Fedotov (1925), also removes the genus from the trilobites, considering it a typical phyllopod of the order Conchostraca, very close to the Cladocera but more primitive than the recent forms. K. L. Henricksen (1928), according to Richter's review, arrived at the following conclusions: *Marrella* does

not possess a carapace, and as a result of a wrong determination of an unmovable head spine as "antennule" the appendages of the head have been misunderstood. The only character it has in common with the trilobites is that all segments of the trunk bear legs. All other characters, among them the possession of  $A_2$ , oppose its reference to the trilobites and point rather to the Notostraca (with exception of the strong development of  $A_2$ , the division of the legs, the absence of a carapace). Fedotov's suggestion of the relationship of *Marrella* with Conchostraca and Cladocera is nullified by such characters as the flat, free head, the widely separated eyes, and other features. If Walcott considered *Marrella* more highly developed than *Apus*, he reversed the facts, since the lack of division of the legs of *Apus* is a later development. (Fig. 3.) There is nothing similar to it among the trilobites, especially now that Barrande's figure of *Bohemilla*, which could perhaps have been quoted, has been

corrected by Klouček. *Marrella* is therefore a primitive branchiopod of still simpler structure than the Notostraca [Richter].

This brief survey shows that *Marrella* has thus far remained a very fractious puzzle and that any additional knowledge concerning it would be most welcome. In fact, a study of the large quantity of material now made available, with the

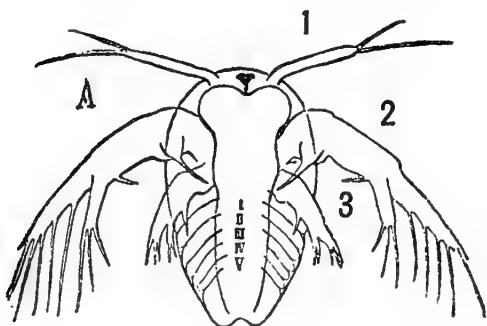


FIGURE 3.—Early growth stage of *Apus*: 1, 2, 3, Cephalic appendages; 1, II, III, IV, V, body segments. (From Lang's Comparative Anatomy)

new ultra-violet light method, is most desirable. For, as we shall see presently, here is a Cambrian trilobite freshly molted and exhibiting all its body anatomy!

In the small suite of slabs containing the problematic fossils from the Burgess shale, suggestive of graptolites, was one bearing several specimens of *Marrella splendens*. When these, with the supposed neighboring graptolite, were brought under the Lapworth-Parkes microscope, not only the amazing delicacy of the body but also the distinct identity of the appendages with those of a trilobite became apparent. Likewise the absence of any protecting carapace was too evident to be overlooked. All these observations point toward the fact that the fossil may represent a freshly molted trilobite. Following up this clew, the writer recalled having previously read of such a suggestion, and a search of the literature revealed that Edgar Dacqué, in his brilliant *Vergleichende biologische Formenkunde der fossilen niederen Tiere* (1923, p. 703), incidental to the discussion of the fact that many trilobite carapaces, especially when heaped

together, are the cast-off tests of molting individuals, had remarked: "It is possible that, among others, the soft-shelled crustaceans described by Walcott from the North American Middle Cambrian as *Marrella* and *Molania*, whose systematic position could not be established thus far, may be soft-shelled crustaceans, namely, trilobites immediately after molting" (translation).

Working with this suggestion in mind, the writer found from Walcott's figures and the material in the New York State Museum the following evidence:

(1) The tests were so delicate that the animals clearly had insufficient protection. Walcott (1912, p. 194) states that in camp the fossils were called the "lace crab" because of their delicate tissue. It is probable that these young freshly molted individuals, in seeking the protection of deeper and darker places, as molted crustaceans do, had the misfortune of sinking into the trap formed by the water charged with carbonic acid that filled the particular depression in which the Burgess shale with its amazing number of species was deposited, just as the other amazing accumulation of organisms was formed.

(2) Walcott saw the distinguishing characters of his family *Marrellidae* in the "small subquadrangular carapace," "the two posterolateral spines comparable with the lateral lobes of the carapace of *Apodidae*," and "the five pairs of appendages of the head."

It is these appendages that furnish the solution of the problem. Though the antennae are clearly the same as those described in the trilobites, the strangest appendages and those most divergent from trilobites are the two pairs of long, thick horns. Walcott termed the first of these "antennulae (?)" and the other "the posterior spines or lobes of the carapace."

In most specimens the first pair projects horizontally, or sideways, coinciding exactly with the frontal margin of the trilobite cephalon, including the genal spines. The other pair is most frequently turned so far backward that it flanks the two sides of the trunk. There are, however, many specimens, and among them some that have suffered little disturbance in preservation, that have the "posterior" spines projecting sideways, as in Walcott's Plate 26, Figures 3 and 5. In this position they correspond exactly in location and outline with the posterior margin of the cephalon.

These two pairs of appendages may, therefore, very well have been the strands of thicker connective tissue, supplied with blood vessels and nerves that lay under the frontal doublure and the posterior furrowed margin of the cephalon and between which the thin membrane of the cheeks was stretched out. This assumption is well supported by the fact that the posterior margins of the anterior appendages and the anterior (outer) margins of the posterior appendages distinctly

show jagged edges, indicating that there a connecting membrane was torn away. This is well shown on the anterior appendages in Walcott's Plate 25, Figures 2 and 6, and Plate 26, Figures 5 and 6, and for the posterior appendages in Plate 26, Figures 1 (fig. 4 and pl. 6, fig. 1, of this paper) and 4.

Still more convincing is the fact that one of the specimens figured by Walcott (pl. 25, fig. 3) retains, on the left side, the cheek of the cephalon itself, together with the eye cavity (ventral side), which shows from under the "appendage" that has separated from the test.

Therefore, if the two pairs of appendages are placed in their normal position, as in the accompanying diagram (fig. 5), the margin of the head of the trilobite is fully outlined. The head in propor-

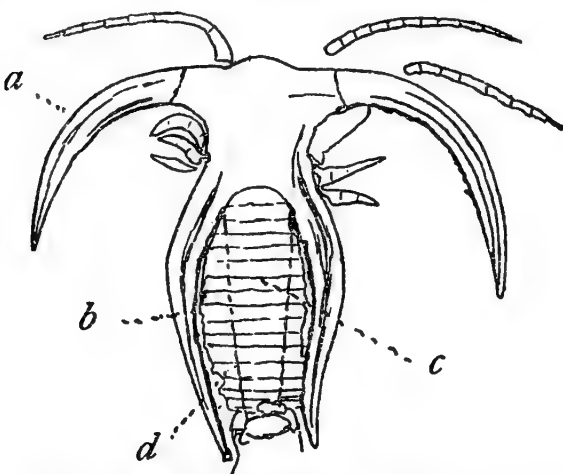


FIGURE 4.—*Marrella splendens*. Walcott's Plate 26, Figure 1. (Letters correspond to those in fig. 5)

tion to the trunk is very large—a fact that corresponds to the supposed larval age of the individuals—and the posterior appendages extend into the genal spines.

The backward direction of the "posterior spines of the carapace" is therefore only a post-mortem position of the fossils.

(3) The antennae ( $a''$  in Walcott's drawings) are the same as in the other trilobites, as drawn

by Beecher and Walcott. They are like those of *Neolenus serratus*, even to the rows of setae.

The so-called "mandibles" ( $m$ ) of Walcott are the same as "the posterior spines of the carapace," when they are in their normal horizontal position, clearly seen in his Plate 26, Figure 5.

The maxillulae ( $m'$ ) and maxillae ( $m''$ ) are the four pairs of longer limbs on the last segments of the carapace, and the same as in *Neolenus serratus* from the Burgess shale and other trilobites.

This brings all "five pairs of appendages" of *Marrella splendens* in complete agreement with the trilobites.

(4) The "strong, small subquadrangular carapace" of *Marrella splendens* is the compressed mass of organs, notably the stomach, contained in the glabella of the trilobite. This is shown in Walcott's excellent Figure 2 of Plate 25, in which the intestine is seen extending backward from the stomach and, where torn, exhibits the intestinal cavity.

(5) The "labrum" (*lb* in pl. 26, fig. 2) is a typical trilobite hyposoma, similar to that of *Neolenus serratus* and *Ogygopsis klotzi*.

(6) The muscle attachments, shown as rows of tubercles on the axial lobe of the abdomen (in pl. 25, figs. 1 and 5; pl. 26, figs. 3 and 4) are exactly the same as repeatedly figured for trilobites, for example, by Hall and Clarke<sup>2</sup> from specimens where the test was either exfoliated or transparent.

(7) According to our material and Walcott's drawings, the legs, both of the carapace and abdomen, are the same as those of trilobites. The gills of the third to fifth legs of the head are, for instance, well

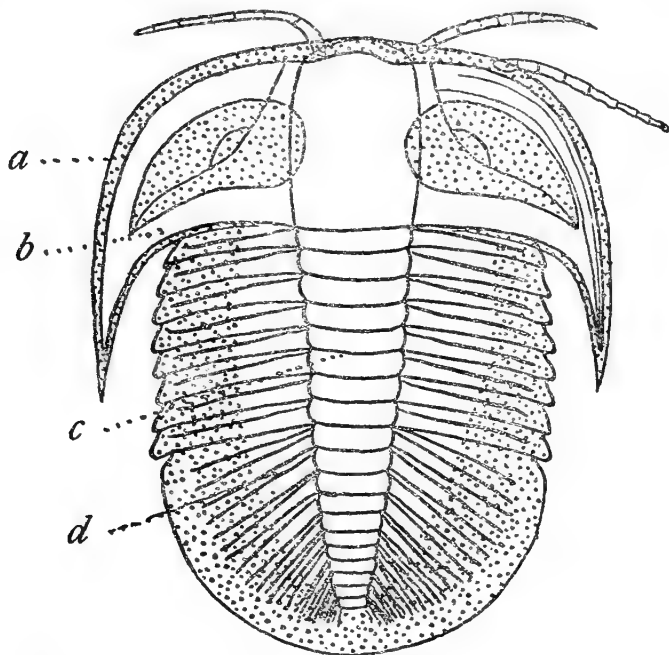


FIGURE 5.—A young trilobite with large cephalon, showing in white the portion preserved in the specimen of *Marrella splendens*: *a*, Frontal tissue strand of cephalon; *b*, posterior tissue strand of cephalon and genal spines; *c*, axial lobe of thorax; *d*, proximal portion of pleura

shown in Plate 25, Figure 3—on the right side—also in Plate 26, Figures 3 and 4. All legs possess "the jointed leg-like endopodite, a jointed setiferous exopodite, and expanded gill-like epicoxite," which Walcott recognized only for those of the abdomen.

(8) The abdomen in the molted specimens retains only the axial lobes without the pleura, a feature that has aided strongly in obscuring the trilobite nature of *Marrella*. It is probable that, as in the case of the cephalon, the pleura were represented by thin soft membranes, which later in life gave rise to the harder chitinous shell. (Fig. 5.) Possible traces of thicker tissue strands in these pleural

<sup>2</sup> Paleontology of New York, vol. 7, pl. 23, fig. 8; pl. 25, fig. 8; 1888.

membranes may be seen in Plate 26, Figures 4 and 6, on the right side, while the specimen shown on Plate 26, Figure 1, retains the thin tests of the pleura themselves on both sides of the axis.

(9) Finally, we have a specimen from our State Museum collection clearly showing the pygidium as a fine carbonaceous film (see pl. 3, fig. 2), a result of the retention of the thin pygidial membrane after molting.

Combining all these facts, we have no hesitation in considering *Marrella splendens* a trilobite in a young, freshly molted stage—probably *Neolenus serratus*, which possesses the same general outline, especially in the carapace and pygidium.

The caudal rami found by Walcott in *Neolenus* and probably doubtless also present in other trilobites have not yet been seen in *Marrella splendens*. They are, however, exceedingly delicate appendages that may well have been lost in the molting, or rather in fossilization.

From lack of material I have not taken up the supposed relationship of *Molania spinifera* to the trilobites, suggested by Dacqué.

Half a year after the preceding discussion had been written, Dr. C. E. Resser, of the United States National Museum, informed me that considerable additional material on *Marrella splendens*, including a number of photographs, had been found and should be used. Some of these excellent pictures, which bring out additional features of *Marrella* worth recording, are reproduced herewith. They have not been retouched.

Plate 6, Figure 1, is an enlarged portion of Walcott's Plate 26, Figure 1. It shows the distinct outline of the glabella with the glabellar furrows and a narrow portion of the fixed cheeks, the remainder of which has been torn away along the jagged edge. The flatter occipital ring is recognizable posterior to the glabella. From it proceed the posterior thickened margins of the cephalon, which are here turned backward. The anterior converging sections of the facial suture are preserved where it crosses the frontal margin of the cephalon.

Plate 6, Figure 2, is a somewhat obliquely compressed specimen. It also shows the glabella, the axial lobe of the thorax with the muscular attachments of the legs, and the pygidium. The latter clearly exhibits the axial lobe extending three-fourths of the length, and also the marginal doublure on the left.

Plate 6, Figure 3, again shows the cranium with the short sectors of the facial suture on the broad frontal "horns" (margins of carapace). This specimen demonstrates the fact that with the exception of the pair of antennules there are no antennae, mandibles, or maxillae, which Walcott had been led to believe were present, but only biramous cephalic and thoracic legs, the endopodites of which are



developed into gills as in the classic *Triarthrus becki*. In contrast to this the adjoining figure shows the thoracic feet stripped of the endopodites, and therefore looking like cephalic appendages. Some of Walcott's drawings (pl. 25, fig. 6, and pl. 26, figs. 2-4) also show cephalic feet with gills. Where Walcott figures antennae, mandibles, maxillulae, and maxillae (pl. 25, fig. 1, and pl. 26, figs. 1 and 5), the posterior margin of the cephalon, as shown before, is mistaken for the mandible, and the cephalic feet, which have lost their endopodites by poor preservation, for maxillulae and maxillae. This misconception led Raymond (1920, p. 116, fig. 32) to an erroneous restoration of *Marrella splendens*, showing five pairs of uniramous cephalic appendages, and to the statement (*ibid.*, p. 143) that *Marrella* forms "an intermediate stage between the Trilobita and the higher Crustaceae."

Plate 7, Figure 1, gives a ventral view, exhibiting the frontal doublure and the hypostoma. The transversal suture just behind the frontal margin appears to represent the frontal portion of the uniting facial sutures, with a rostral plate posteriorly to it. The most distinctive feature is the presence of white strands of connective tissue extending sideways from the anterior margin of the oval hypostoma into the frontal thickened margins of the free checks. Behind the glabella a portion of the intestine is seen, and behind this the internal view of the axial lobe of the thorax. The lower half of the picture shows more clearly the crowded, partly overlapping joints (segments of Raymond) of the posterior portion of the thorax.

Plate 7, Figure 2, is important in shedding light on the character of the supposed "large crescentiform sessile eyes," which "occur on the anterior margin just within the base of the anterior spines." (See Walcott's pl. 25, figs. 4 and 5.) Raymond speaks (p. 115) of "large marginal sessile eyes." Figures 3 and 4, which are further enlargements of the "eyes" in Walcott's Figures 4 and 5, show these bodies to be really circular to oval in outline. In both specimens they are squeezed out of place with respect to the thin test of the carapace, in the original of Figure 3 laterally and in that of Figure 4 anteriorly, both specimens showing oblique compression by their general outlines. In Figure 4 a triangular patch of the test adhering to the gland on the right and in Figure 3 the gland on the right (partly cut) are distinctly integral parts of the test. In Figure 2 they are in their normal position, which is under the cephalon at both sides of the glabella. This location, as well as their outline, the indications of their composition of concentric or spiral ducts (as seen especially in fig. 3), and their prominence directly after the molting suggest their nature as shell glands rather than as digestive glands or hepatic ceca. It is quite probable that

these same shell glands are also retained in peculiar cranial depressions of full-grown trilobites, as, for example, in the "lunettes" of *Bumastus*. Anyone who has observed the prominent shell glands in the carapace of an *Apus* or noted their location in such other primitive crustaceans as *Branchipus* and *Daphnia* (fig. 6) or the prominent development of the maxillary or shell glands in the larval forms of the Branchiopoda, Ostracoda, Copepoda, and Cirripedia will expect to see shell glands as a distinct feature in the freshly molted trilobites and will not be surprised to see their markings retained on the inside of the carapace of mature individuals.

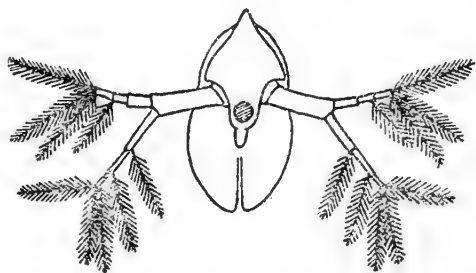


FIGURE 6.—*Daphnia longispina* O. F. Müller.  
Frontal view. (After Woltereck)

Plate 6, Figure 1, as well as Plate 7, Figures 1 and 2, shows clearly the torn and ragged posterior (interior) edges of the frontal "horns," which though considered appendages by Walcott and Raymond, are in reality the frontal doublure of the cephalon.

*Occurrence*.—Middle Cambrian, Burgess shale (Loc. 35K), Burgess Pass, near Field, British Columbia.

*Plesiotypes*.—U.S.N.M. No. 83486.

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## EXPLANATIONS OF PLATES

## PLATE 1

*Dictyophycus gracilis*, new species

- FIGURE 1. Holotype,  $\times 2$ . Portion of frond with well-preserved regular network of fibers.
2. Small group of fibers compressed on another indistinct fossil.  $\times 2$ .
3. Largest specimen observed, probably composed of several thalli.  $\times 2$ .

## PLATE 2

*Dictyophycus gracilis*, new species

- FIGURE 1. Portion of network drawn with Lapworth-Parkes microscope to show irregular character of meshes.  $\times 4$ .
2. Portion of network with fine pores; also traces of parallel lines.  $\times 4$ .
3. Specimen retaining softer part of the thallus besides the network of ribs.  $\times 4$ .

*Chaunograptus scandens*, new species

FIGURES 4, 5. Opposite sides of another hydrozoan, with larger hydrothecae.  $\times 4$ .

6. Camera drawing of type to show character of hydrocauli and hydrothecae.  $\times 4$ .

## PLATE 3

*Marrella splendens* WALCOTT

FIGURE 1. Camera drawing of freshly molted specimen in New York State Museum, showing hypostoma (*a*), fine parallel sculpture lines of crustacean carapace, bifurcation of legs (*c*), and thin epidermis film of pygidium (*p*).  $\times 4$ .

2. Unretouched photograph of same specimen, showing the lateral compression of pygidium.  $\times 4$ .

*Chaunograptus scandens*, new species

3. Photo of counterpart of type specimen, slightly retouched.  $\times 4$ .

## PLATE 4

*Chaunograptus scandens*, new species

FIGURE 1. Another slab retaining mostly hydrocauli and a few hydrothecae.  $\times 4$ .

*Marria walcotti*, new species

2. Photo of holotype, not retouched.  $\times 2$ .

3. Drawing made with Lapworth-Parkes microscope to bring out details of structure.  $\times 4$ .

## PLATE 5

FIGURE 1. Restoration of *Marria walcotti*, new species.

## PLATE 6

*Marrella splendens* WALCOTT

FIGURE 1. Cranium of original of Walcott's Plate 26, Figure 1.  $\times 9$ .

2. View of obliquely compressed specimen, showing glabella and pygidium.  $\times 3$ .

3. Dorsal view of specimen showing glabella, frontal sections of facial sutures, gills on cephalic appendages (left upper side), and axial lobe of thorax. The axial segments appear to continue into the pleura on the right side, beyond which traces of the feet are seen.  $\times 3$ .

## PLATE 7

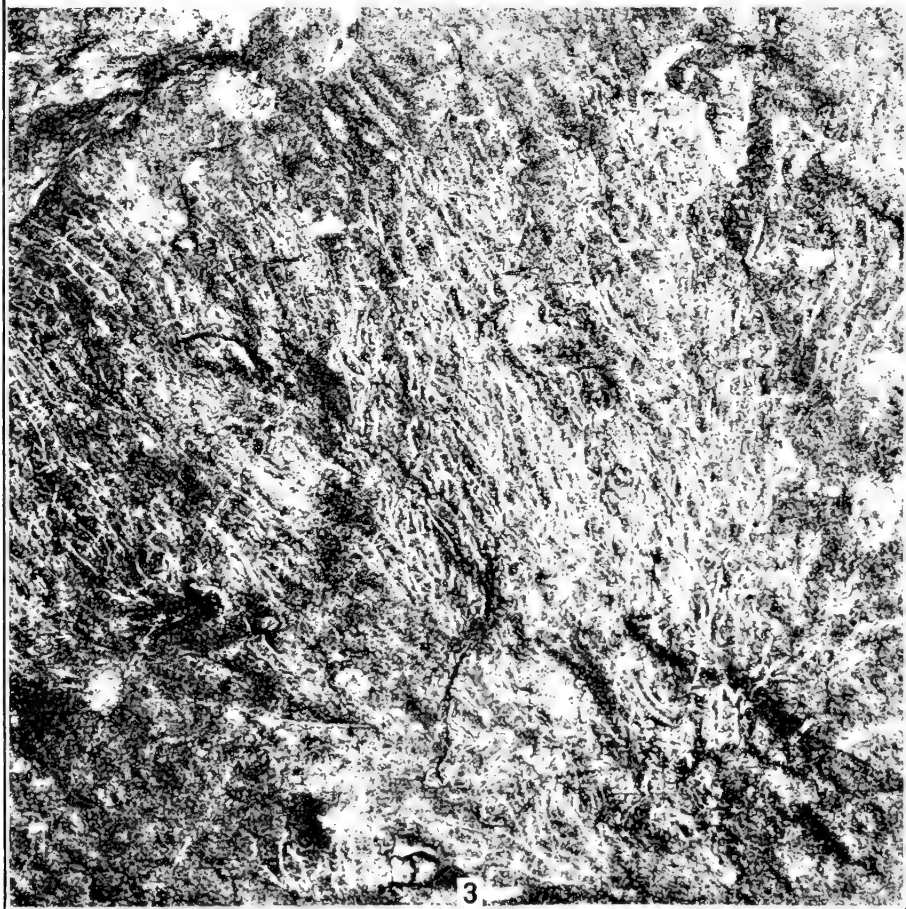
*Marrella splendens* WALCOTT

FIGURE 1. Ventral view of specimen.  $\times 3$ .

2. Dorsal view showing shell glands in position.  $\times 3$ .

3. Frontal portion of glabella with shell glands.  $\times 9$ . Portion of Walcott's Plate 25, Figure 4.

4. Frontal margin of glabella, with shell glands. Portion of Walcott's Plate 25, Figure 5. The frontal lobe of the glabella is forced beyond the white transversal doublure of the cephalon and embraces the circular shell glands.  $\times 9$ .



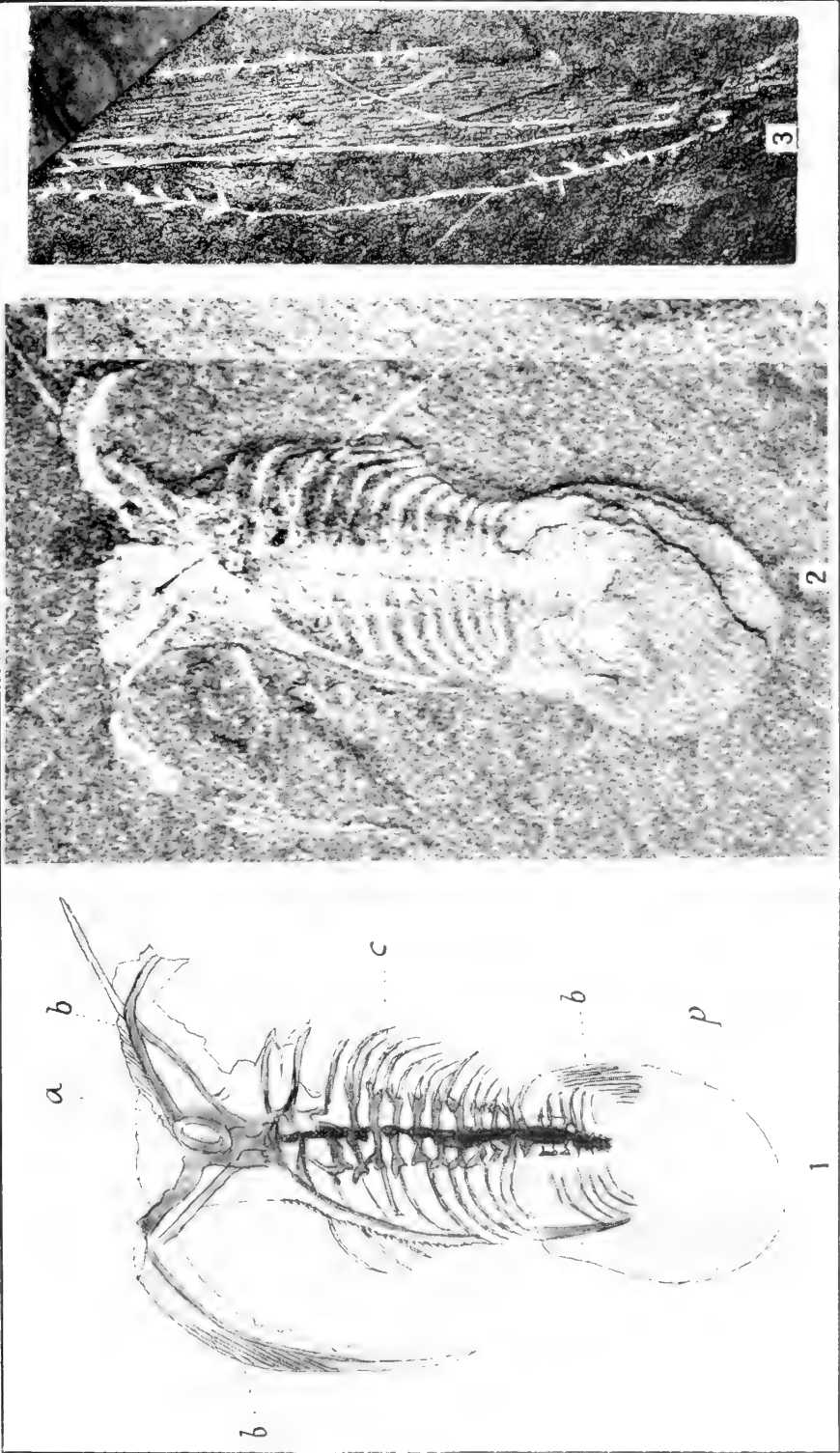
*DICTYOPHYCUS GRACILIS*, NEW SPECIES

FOR EXPLANATION OF PLATE SEE PAGE 17.

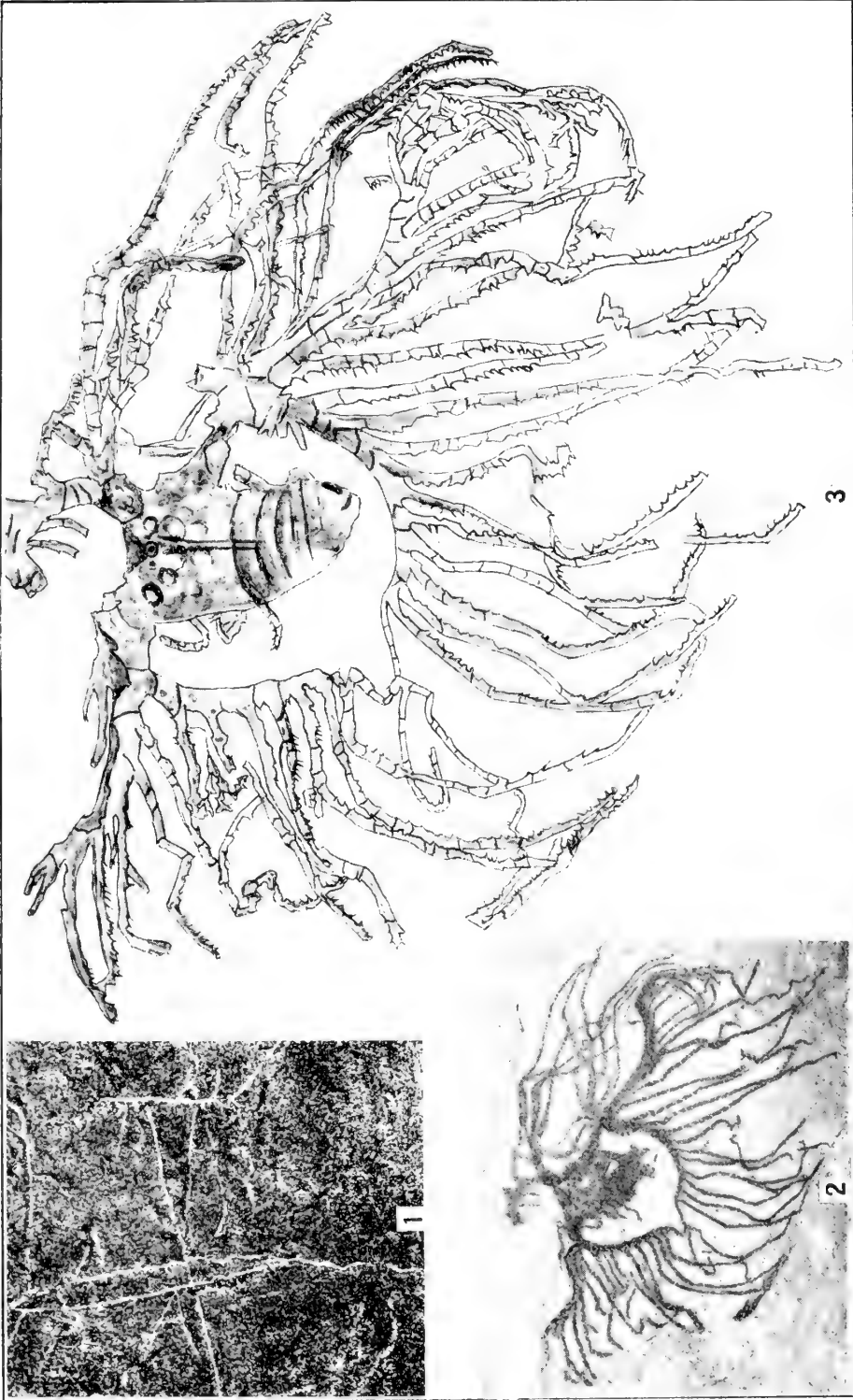


DICTYOPHYCUS GRACILIS, NEW SPECIES, AND CHAUNOGRAPTUS SCANDENS,  
NEW SPECIES

FOR EXPLANATION OF PLATE SEE PAGES 17, 18.

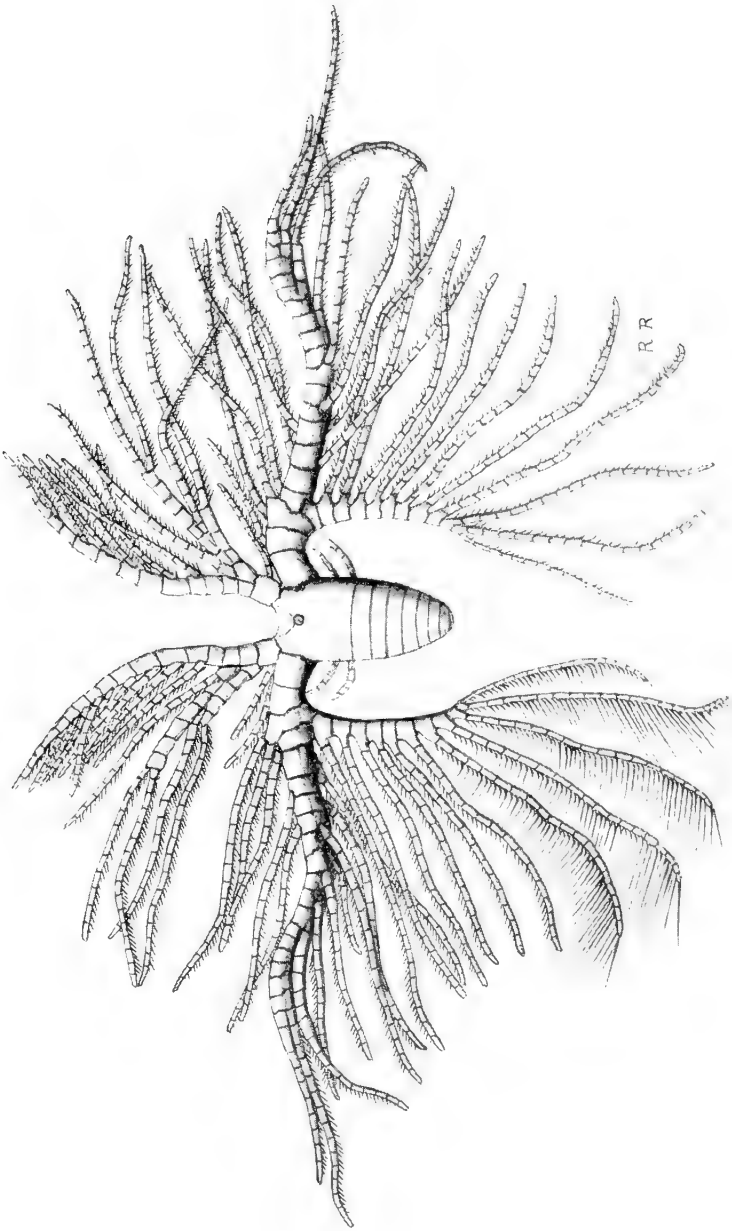


MARRELLA SPLENDENS WALCOTT AND CHAUNOGRAPTUS SCANDENS, NEW SPECIES  
FOR EXPLANATION OF PLATE SEE PAGE 18.

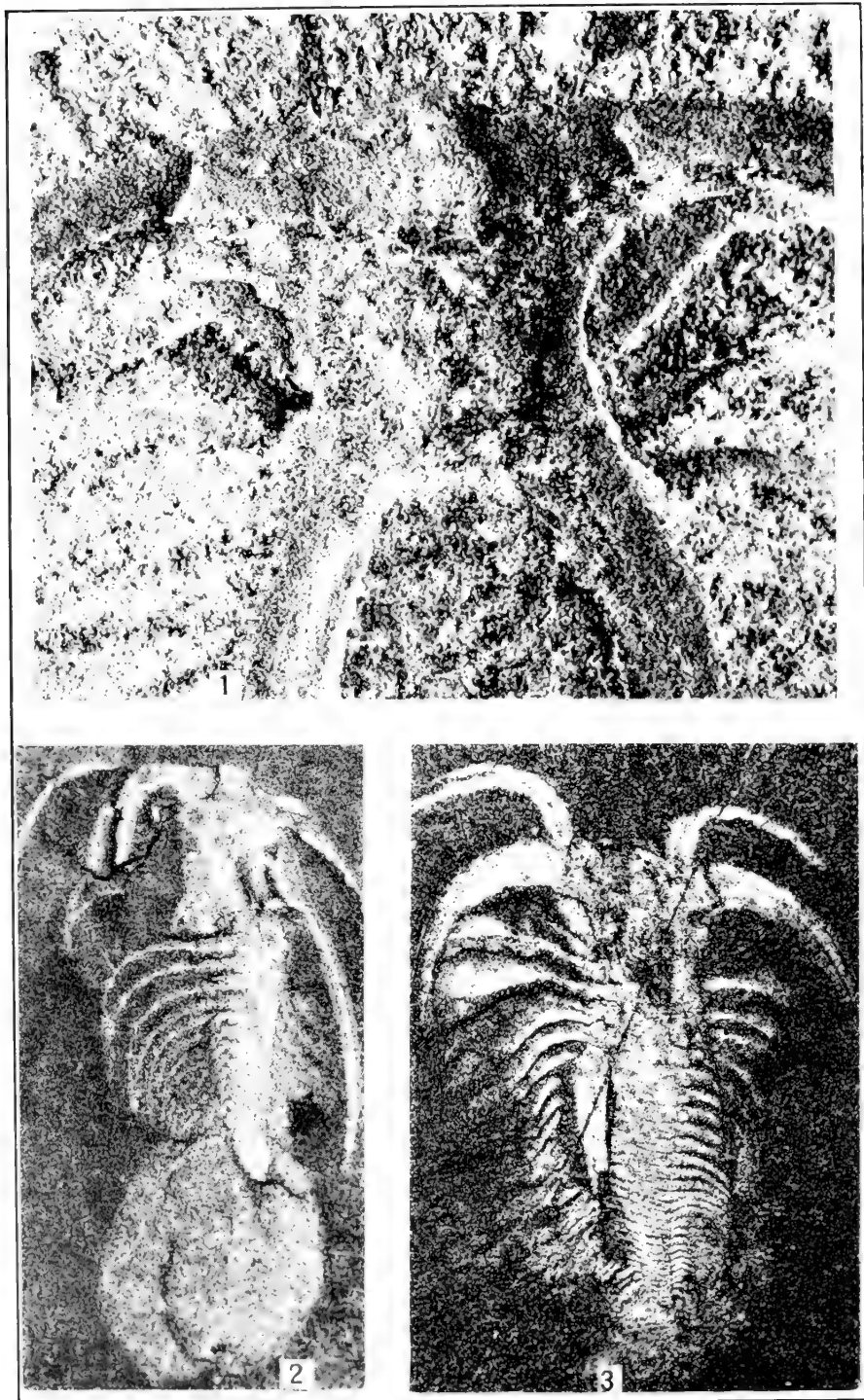


CHAUNOGRAPTUS SCANDENS, NEW SPECIES, AND MARRIA WALCOTTII, NEW SPECIES  
FOR EXPLANATION OF PLATE SEE PAGE 18.



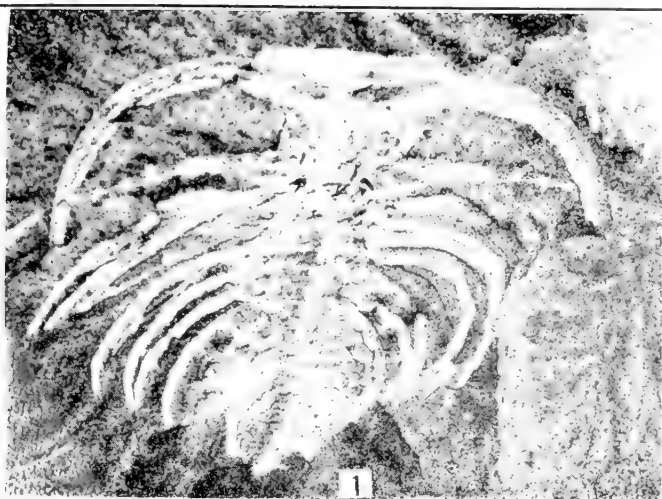


MARRIA WALCOTTI, NEW SPECIES  
FOR EXPLANATION OF PLATE SEE PAGE 18.



MARRELLA SPLENDENS WALCOTT

FOR EXPLANATION OF PLATE SEE PAGE 18.



MARRELLA SPLENDENS WALCOTT

FOR EXPLANATION OF PLATE SEE PAGE 18.



# REVISION OF THE CHALCID FLIES OF THE TRIBE DECATOMINI (EURYTOMIDAE) IN AMERICA NORTH OF MEXICO

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## INTRODUCTION

The family Eurytomidae is one of the least studied groups of the large superfamily Chalcidoidea. On account of the outstanding economic importance of its species as pests on grasses and small grains, the genus *Harmolita* Motsch has received more attention than any other of this family. Sundry habits are represented in the very difficult genus *Eurytoma* Illiger, the outstanding one probably being parasitism on other insects. Comparatively little is known about the latter group, and still less information has been produced regarding the biology of the Decatomini and most of the smaller genera falling within this tribe. The fact that the Decatomini are mostly gall-colours explains the absence of a larger body of facts about their habits, and only a few workers, chiefly of the present day, seem to have been at all interested in preserving specimens of this tribe reared from galls incident to their study of the Cynipidae. As a result, most of the species of the group are represented by relatively small series of specimens, and many species probably still remain undiscovered. The present revision treats 30 species and 5 varieties, of which 14 species and 3 varieties are new. The species previously recorded in the literature were described by Fitch, Walsh, Ashmead, Girault, and Fullaway. The present intensive work of Dr. A. C. Kinsey and L. H. Weld on the Cynipidae has produced most of the new material described herein. In addition to the material received from Messrs. Kinsey and Weld, and specimens reared myself, I have studied the Decatomini in the collections of the United States National Museum, the Canadian Department of Agriculture, a series from Stanford University, California, a small lot belonging to the Illinois State Natural History Survey, and a few specimens from several other State and personal collections.<sup>1</sup> It is to be hoped that the rear-

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<sup>1</sup> No doubt additional specimens are housed in various museums of North America, and I shall welcome the opportunity to study any such material that anyone will send me at the University of Illinois, Urbana, Ill.

ing of members of the Decatomini, and Eurytomini also, from galls and other sources, will continue to increase, and thus supply within a few years what may prove to be representatives of most of the species of these tribes in our fauna. Only then may we pretend to produce a complete revision of the tribe Decatomini.

In another sense, also, the present study is in part tentative. The limits of certain species, for example *Decatoma dubia* Walsh, *D. globuli*, new species, and *D. nigriceps* Walsh, can not be determined with precision until their habits can be studied in considerable detail. An effort to separate the species on the basis of male genitalia has not been made, because adequate material of this sex is not at hand. It is probable that the necessary technique for the study of minute parts of these small insects can be developed, but many additional specimens, obtained by careful rearing that involves determination by experts of both the plant and animal hosts, need to be provided before a comprehensive study of the taxonomic value of male genitalia can be profitably undertaken. In view of the great variations in color and size and sometimes sculpture and dimensions the question of species limits, which constitutes the chief problem in a study of this nature, is therefore not fully answered. It has been possible, however, to identify with practical certainty all specimens that came to my attention.

Many specimens were dissected in balsam and permanently mounted on slides with the expectation that valuable characters might thus be discovered. I have concluded, however, that all the characters that really prove to have value for distinguishing species can be seen on the entire specimens by the aid of the ordinary higher powers of a good binocular microscope.

#### ACKNOWLEDGMENTS

I have been aided in this study by various institutions and persons who have supplied specimens, provided instruments, or given advice and criticism. Their assistance is appreciated. I am particularly pleased to acknowledge my obligation to the board of trustees and the chairmen of the Bache Fund, Prof. Ross G. Harrison, of Yale University, and Prof. H. S. Jennings, of Johns Hopkins University, for grants that made possible the initiation of this study at the United States National Museum in the summer of 1926 and the subsequent preparation of material for study and the execution of drawings found in this paper. Funds under the administration of Dean A. H. Daniels, of the graduate school of the University of Illinois, were made available for mounting large numbers of the Kinsey specimens, and I am grateful for this sympathetic support.

## EXPLANATION OF TERMS

*Dimensions of the head.*—Measured by aid of an ocular micrometer. Both width and length measurements were taken from the dorsal view at an angle and a position that gave the maximum dimensions.

*Cubital row.*—A rather well-defined line of hairs not different in size from other hairs on the apical third of the front wing. It is best visible at an acute angle, and extends lengthwise across the outer third about midway between the front and hind margins of the wing. It is designated "cubital" because it seems to have the position of that vein as figured by Snodgrass (Proc. U. S. Nat. Mus., vol. 39, pl. 16, fig. 77, 1910). (Pl. 3, fig. 33, *f.*)

*Subdiscoidal row.*—A line of hairs similar to but somewhat more readily discovered than the cubital row, and located caudad of it and extending in general parallel with the hind margin of the wing. In species having a fully developed color band, the subdiscoidal row passes near the apex of this band. (Pl. 3, fig. 33, *g.*)

*Secondary band.*—In some species there occurs a second, but usually more faint and always smaller and irregular, band of color across the wing proximad of the main or submarginal band and coextensive with it. (Pl. 1, figs. 2 and 5.)

*Funicular joints.*—Frequent reference is made in the descriptions to the several joints of the antennae. For convenience each joint of the funicle is designated by a letter-figure combination, F for funicular joint, and the following figure referring to the particular joint under consideration. For example, F4 designates the fourth funicular joint, counting from the base of the funicle. The female Decatomini possesses five such joints, whereas the male has only four. (Pl. 3, figs. 30 to 32; pl. 4, figs. 41, 42.)

## Tribe DECATOMINI: Family EURYTOMIDAE

The Eurytomidae are easily distinguished from the other families of Chalcidoidea, except the Callimomidae, by the form of the pronotum, and from the latter family by the shorter ovipositor and the form of the antennae and the abdomen. The front and hind margins of the pronotum are nearly parallel, and the sides slightly convergent posteriorly, or the sclerite as a whole is subquadrate, usually about twice as wide as long. (Pl. 3, fig. 27.) In the female Eurytomidae the abdomen is moderately to strongly compressed, but in the males this region is subcylindrical, somewhat as in the Callimomidae. The latter group possesses a relatively undifferentiated flagellum, which, in the Eurytomidae, consists of a distinct funicle and more or less developed club. Moreover, the colors of most Eurytomidae are dull, but the Callimomidae have a metallic surface.

The tribe Decatomini<sup>2</sup> differs from its nearest relatives, the Eurytomini, and other tribes of the family in possessing a distinct stigma (pl. 1, figs 1 to 13, et al.) near the middle of the anterior margin of the front wings. Ashmead<sup>3</sup> recognized two genera in this tribe, splitting his genus *Eudecatoma* from *Decatoma* Spinola on the absence of a submarginal color band on the front wings. No adequate structural differences, however, have been found that supplement this somewhat variable character in the color band to justify this division of the old genus *Decatoma*. To Masi,<sup>4</sup> also, *Eudecatoma* Ashmead does not seem sufficiently different to regard it as a separate genus. These genera have therefore been recombined in this study, and the tribe Decatomini, as known in America north of Mexico, includes the single genus *Decatoma* Spinola.

### Genus DECATOMA Spinola

*Decatoma* SPINOLA, Classification des diptolepaires, Ann. Mus. d'Hist. Nat., vol. 17, p. 151, 1811.—WALSH, Amer. Ent. and Bot., vol. 2, no. 10, p. 300, 1870.—ASHMEAD, Trans. Amer. Ent. Soc., vol. 9, p. xxxi, 1881.—PROVANCHER, Petite fauna entomologique du Canada et particulièrement de la Province de Quebec, vol. 2, Hymenoptera, pp. 568-569, 1883.—HOWARD, U. S. Dept. Agr., Div. Ent. Bull. 5, pp. 38-39, 1885.—ASHMEAD, Ent. Americana, vol. 4, no. 3, pp. 42-43, 1888, new genus *Eudecatoma*.—ASHMEAD, Trans. Amer. Ent. Soc., vol. 21, p. 319, 1894 (*Diptolepis adonidum* Rossi as the genotype).—BRUES, Bull. Mus. Comp. Zool. 54, p. 25, 1910.—MASI, Nov. Zool., vol. 24, p. 138, 1917, *Eudecatoma* Ashmead synonymous with *Decatoma* Spinola.—GAHAN and FAGAN, U. S. Nat. Mus. Bull. 124, 1923, list of type species, *Decatoma*, p. 59, and *Eudecatoma*, p. 42. Only the chief papers on the genus are listed.

Maximilian Spinola described *Decatoma* as genus No. 19 with a series of other genera, as follows, the first phrase occurring in the key: "Antennis de dix articles, inserees au milieu du front. \* \* \* N. 19. *G. Decatoma*. Abdomen petiole, comprime lateralement, \* \* \* Mihi. Ex. *Chalcis adonidum* Rossi, *Diptolepis Sphegnum*, *stigma* Fabr. etc. *Decatoma splendida*, *metallica*, *rufipes*, *albitarsis* mihi. Medites, etc."

*Female*.—Length 1.5 to 4 mm., moderately robust in form, or no more than four times as long as maximum width (head and mesothorax), varying from almost black through brown to nearly completely yellow, the intermediate colors being combinations of black, brown, red, and yellow, black species with cephalo-lateral angle of pronotum yellow, yellow species with at least a part of hind legs partly fuscous to black; submarginal band lacking, or faint pale brown to deep brown, a faint secondary band broadly V-shaped and on ridge between band and base of wings sometimes present.

<sup>2</sup> Ashmead, Classification of the chalcid flies. Mem. Carnegie Mus., vol. 1, no. 4, 1904.

<sup>3</sup> Ent. Americana, vol. 4, no. 3, pp. 42, 43, 1888.

<sup>4</sup> Nov. Zool., vol. 24, p. 138, 1917.



Head usually from two-thirds as broad as long to twice as broad as long, oval to subrectangular in outline above, moderately to slightly convex in front, eyes and malar space nearly equal in length, surfaces reticulate, each reticulation with a small hair-bearing umbilicate puncture, except sometimes cheeks and malar space more or less smooth and shiny, and occasionally cheeks strigose, and usually vertex finely and densely punctate, malar groove broad and well defined usually only on basal half (nearest to eyes); punctate areas of head moderately and inconspicuously hairy, ocelli forming a low triangle, median ocellus very close to upper edge of antennal scrobe; scape of antennae about three times as long as pedicel, and more or less thickened on basal half, pedicel always longer by about one-third than F1, narrow at base and expanding quickly from basal fourth, scape usually reaching about to middle of F3. one ring-joint, five funicular joints constant, F2 to F5 varying in dimensions, sometimes much longer than thick, but mostly not much longer than their greatest diameter, and at times slightly broader than long; club 3-jointed, compact, usually not so long as F3 to F5 combined and slightly broader than the rest of the antenna, widest at second joint, the third small and conical with blunt tip; flagellum moderately clothed with rather short inconspicuous whitish hairs; joints of funicle and club with elongate shallow hair-bearing, and also dot-like, sensoria, quite uniform in number and arrangement. (Pl. 3, figs. 30, 31.)

Pronotum and sclerites of mesothorax above hairy like the face, and umbilicately punctate, becoming smoother at the lower edges where femora fold against the body; prescutum, scapulae, axillae, and scutel definitely distinguished by well-developed sutures and moderately rounded above (pl. 3, fig. 29), mesopleura with lateral area below tegulae and anterior to metapleural cluster of silvery hairs, bare, shagreened, and aciculate-punctate; metapleura punctate and always clothed with a broad, rather dense covering of long silvery hairs; pronotum subrectangular, transverse, front and hind margins almost parallel (pl. 3, fig. 27), sides slightly converging toward rear, about twice as broad as long and transversely arched, length about equal to that of prescutum, usually slightly more narrow than maximum width of mesothorax. latter broadest across tegulae; front legs shortest, but their coxae intermediate in breadth and length between length of meso- and metacoxae, first and second tarsal segments almost equal in length, third and fourth shorter and nearly same length, last segment longest, bearing a pair of simple claws, strigilis with a row of fine short stiff hairs on first tarsal joint, curved tibial spur reaching to about middle of this segment; midlegs most slender, tibiae with a strong apical spur, first and last

tarsal segments longer than two to four, these subequal; hind femora moderately thickened, two strong apical spurs on tibia, outer member about half the length of the inner, proportionate size of tarsal joints as on midlegs; outer face of hind coxae with a narrow band of silvery hairs lengthwise, and hind edges of hind tibiae bordered with two poorly defined rows of long stiff hairs; metanotum very short, transversely curved, its anterior and posterior margins parallel; propodeum about two-thirds wider at front than long, sides rounded and converging broadly posteriorly, median groove moderately developed, usually broad and shallow with bottom rounded, its marginal carinae not always present or complete, groove limited in front by a curved or angulate carina, surface of the segment in part reticulated coarsely to finely, or rugae sometimes lacking just laterad of the groove; spiracles ovate or oval, near cephalo-lateral corners; front wings reaching shortly beyond end of abdomen, hind wings extending halfway between stigma and apex of front wings, latter broadest beyond stigma and twice the width of the hind wings, front margins almost straight, hind margins uniformly oblique, hamular fold on narrow slender thickening on hind margin of basal half; apical two-thirds of front wings mostly densely and minutely hairy and bordered with similar hairs, basal third with a pattern of setae in rows on obscure ridges, submarginal vein slightly thickened proximad of stigma and bearing from 10 to 18 long setae in a single row, stigma situated a short distance behind middle, marginal and stigmal veins shorter than stigma, marginal vein with seven or eight setae, stigmal vein knobbed with a short cephalo-distal tooth, hind wings without large hairs on base, apical two-thirds with vestiture like front wings, three hamuli on front margin short of middle, basal hamulus straight, others recurved.

Petiole about twice as wide as long, rounded and sculptured above, abdomen strongly compressed, rounded above and broadest at upper third, segments converging below, first and second combined shorter than third above, fourth broadly emarginate behind and shorter than third but lateral faces longer and their dorso-ventral margins converging moderately ventrad, those of the third narrowing wedge-like, fifth and sixth segments small, in some specimens telescoped, hidden, spiracles of sixth more or less visible on sides, tips of ovipositor sheaths protruding fairly above oblique posterior face; surface of abdomen smooth, highly polished to very finely coriaceous or granulose, usually bare except segments five and six and sheaths which are hairy, the first sparsely, the latter two more hairy.

*Male*.—Length, vestiture, and sculpturing much as in female; color generally somewhat darker and form more slender, head and thorax slightly broader in proportion to the pronotum than in female; funicle 4-jointed, the first joint longer, F2 to F4 mostly

equal or subequal, and proportionately longer than those of female; petiole almost three times as long as broad, abdomen subcylindrical, posterior segments six in number when fully extended, but apical ones usually not visible, telescoped, first two combined shorter than third, fourth shorter than third, and remaining three tapering to pointed posterior when exposed, penis often partly exerted on pinned specimens.

*Specific characters.*—It has been very difficult to find constant characters for the separation of species of *Decatoma*. Color and sculpture are subject to such individual variation that they can be used only in a restricted way. Some of the variation in color depends on the age at which a specimen is killed, fully matured specimens being generally darker. Other variations may be due to the different rates of fading; the submarginal band of the wing, for example, seems to fade more rapidly than the body colors. The form and extent of the submarginal band vary greatly in certain species, while in others they are nearly constant.

Extensive study of the body sculpture has demonstrated very wide variations in nearly all species; and the time and effort necessary to determine the limits of specific variation in sculpture have not seemed justified.

The vestiture of the body, legs, and wings offers very little of value in the way of specific characters. The general surface vestiture of the wings is for the most part very constant in density and length, though in one species, *D. flamminneiventris* Girault, it is distinctly shorter than normal. The best characters of vestiture are found in the number of setae on the submarginal vein, which varies somewhat with the size of the individual and apparently within certain limits for each species.

The dimensions of the various parts of the body offer some specific differences, though the telescoping of the abdomen and the collapsing of the antennal club must be taken into account in the evaluation of characters drawn from those parts. Some of the most available characters of this sort, though these are not without variation, are found in the dimensions of certain joints of the funicle and in the relative length and breadth of the head, and the contour of the eyes, face, and vertex. Certain of these characters are useful in grouping related species.

The characters that seem to be most useful have been employed in the following key:

#### KEY TO SPECIES OF DECATOMA

- |  |     |
|--|-----|
| 1. Front wing immaculate (pl. 2, figs. 23-26) .....  | 25. |
| Front wing with a more or less distinct color band extending<br>backward over surface from stigma (pl. 1, figs. 1-13; pl. 2.<br>figs. 14-22) ..... | 2.  |

2. Color of body either predominantly yellow of different shades, or predominantly black; if yellow, not more than minor parts black, such as ocellar area, occiput narrowly, mesonotum on disks of prescutum or scutellum narrowly, and anterior surface and groove of propodeum; if black, usually not more than narrow orbital ring, front corners of pronotum, and sometimes venter of abdomen, yellowish (head of *nigriceps* at times more yellow, but this species is known by its length and often reduced wing band)----- 3.
- Color of body mixed, varying in the different species, ranging from black through brown to yellow, none of these colors predominating to the extent described above----- 14.
3. Color predominantly yellow, or a shade of yellow more or less suffused with red or brown, width of submarginal band various----- 4.
- Color predominantly black, submarginal band usually not so broad as length of marginal vein or stigma----- 12.
4. Apicalmost part of distal margin of submarginal band extending well beyond end of stigmal vein (pl. 1, figs. 2, 5, 6, et al.)----- 5.
- Apical part of the band not or barely reaching as far as end of stigmal vein (pl. 1, figs. 3, 4, 7, 12, et al.)----- 8.
5. Length 1.5 mm., body slender, 10 or 11 setae on submarginal band, head, thorax, and abdomen almost, or sometimes entirely, immaculate bright golden yellow----- *texana* (p. 22).
- Length 2 mm. or more, body moderately robust, 13 to 15 setae on submarginal vein, body sometimes almost immaculate but not bright golden, more or less darker than the above----- 6.
6. Body color as if tarnished, yellow suffused with reddish brown. *bicolor* (p. 29).
- Body color plain golden yellow----- 7.
7. Submarginal band mostly very large, proximal margin moderately convex, distal margin sometimes greatly dilated and forming almost an arc of a circle, sometimes both margins moderately and about equally expanded, the band then jug-shaped or one-fifth longer than broad----- *disholcaspidis* (p. 23).
- Submarginal band smaller, proximal margin straight or feebly concave, distal margin never more than moderately dilated, band about two-thirds as broad as long----- *flava* (p. 14).
8. Funicular joints 2 to 5 (female) each about a third longer than thick, or 2 to 4 (male) twice as long as wide, antennae usually smoky black, head often speckled dusky and body lightly infumated----- *vacciniicola* (p. 12).
- Funicular joints as long as broad or scarcely longer (female), or one-half longer than broad (male), antennae usually yellowish or chestnut brown, body not speckled or plainly dusky----- 9.
9. Submarginal band with a distinct neck at stigma, band well-separated from stigmal vein, body quite immaculate golden brownish yellow, only anterior and groove of propodeum black. *mimosae* (p. 25).
- Submarginal band not extremely constricted, body more black, including ocellar area and propodeum in part, and dorsum of abdomen----- 10.

10. Length 2.5 mm., slender, bright golden yellow, ocelli and occiput narrowly, and most of dorsum of abdomen, black or brown-black, thorax immaculate, submarginal band feebly formed, sometimes fading out at apex, then about one-half longer than broad----- *amsterdamensis* (p. 20).  
Length 2 to 2.8 mm., more robust than above, thorax marked black, submarginal bands more distinct----- 11.
11. Disk of scutel more or less black----- *lanae* (p. 19).  
At least ocellar area and occiput narrowly, and prescutum beneath pronotum, and on some specimens scutel in part, black.  
*nubilistigma* (p. 26).
12. Head from above transversely rectangulate-ovate in outline, and almost or quite twice as wide as long, front not prominently rounded, posterior half of sides of abdomen coriaceous in both sexes, body black except anterior-lateral corners of pronotum yellow-brown----- *occidentalis* (p. 58).  
Head from three-fifths to two-thirds as long as wide, front as seen from above prominent, broadly rounded, abdomen not sculptured, or not continuously coriaceous on posterior half of sides----- 13.
13. Length 1.8 to 2.2 mm., 10 to 13 setae on submarginal vein, sides of abdomen unsculptured and polished, submarginal band highly variable in length but not in width, and never entirely lacking in specimens at hand----- *nigriceps* (p. 62).  
Length 2.6 to 2.9 mm., usually about 15 setae on submarginal vein, sides of abdomen usually granulose, at least in female, submarginal band uniformly twice as wide as long----- *globuli* (p. 47).
14. Submarginal band of various shapes, but wider at its widest point than length of stigma or marginal vein, never approaching twice as wide as long, usually but one-fifth or so longer than wide, sometimes abbreviated, then quadrangular in shape----- 15.  
Submarginal band narrow, not broader than stigma or marginal vein, usually twice as long as wide and then usually its apical portion curving toward base of wing, band rarely reduced in length and often with a heel-like prominence on outer margin near stigmal vein----- 19.
15. Head seen from above twice as wide as long, or slightly more robust, face not prominently rounded between eyes or on forehead----- 16.  
Head about four-sevenths to two-thirds as long as wide, face quite prominently rounded as seen from above----- *varians* (p. 33).
16. Length 3 mm., color mostly black, at most only laterals of pronotum yellow, most of its dorsum black.  
*occidentalis* var. *flavifrons* (p. 61).  
Length 3.3 mm. or more, body less black, and more yellow or mixed yellow----- 17.



25. Body mostly black,<sup>5</sup> at most antennae, a narrow ocular band, oral area narrowly, sides of pronotum, tegulae, and most of legs, yellow----- 26.  
 Body less black and more yellow than the above, especially head and thorax, and often also abdomen, more yellow----- 28.
26. Length of body in both sexes about 2 mm., 12 or 13 setae on submarginal vein, head almost or quite two-thirds as long as wide----- *wiltzae* (p. 83).  
 Length usually distinctly more than 2 mm., always so in females, 16 setae on submarginal vein, head one-half to three-fifths as long as broad----- 27.
27. Yellow of pronotum confined to anterior lateral corners, not reaching to hind edge of this segment, legs yellow except coxae, which are black, head from above twice as wide as long, face flat or feebly convex----- *florida* (p. 86).  
 Yellow of pronotum attenuated posteriorly but reaching hind edge of the segment laterad, coxae black, also disks of femora and tibiae especially of middle and hind legs, black, head about three-fifths as long as wide----- *marylandica* (p. 85).
28. Vertex mostly or entirely black, occiput black, the black of these two areas confluent; more or less of middle third of pronotum, all or most of prescutum and scutellum, propodeum entirely, and dorsum of abdomen broadly, black----- 29.  
 Usually only ocellar area of vertex, and occiput narrowly, black, the black of these areas usually widely separated or connected only by a narrow band; thorax with a more or less complete and irregular mid-dorsal longitudinal black band, often not extending to pronotum; anterior surface and groove of propodeum, and often only an irregular band on dorsum of abdomen, black, latter band frequently produced sideways on the segments----- 31.
29. Length 2.2 to 2.7 mm., abdomen of females mostly ochreous-yellow on the sides, 12 to 13 setae on submarginal vein.----- *quinqueseptae* (p. 78).  
 Length 3 to 3.3 mm., sides of female abdomen not always mostly ochreous-yellow, 12 to 16 setae on submarginal vein----- 30.
30. Length 3 mm., 12 to 14 setae on submarginal vein, sides of female abdomen mostly dark like dorsum, only venter or lower portions of sides lighter in color----- *foliatae* (p. 79).  
 Length 3.1 to 3.3 mm., 12 to 17, usually 14 to 17, setae on submarginal vein, sides of female abdomen mostly ochreous-yellow----- *foliatae* var. *arizonica* (p. 82).

<sup>5</sup> The key does not provide for separating certain mostly black males of the *querci-lanae* var. *dorsalis* (Fitch) type. All such will lead to *florida* Girault, *marylandica* Girault, or *wiltzae*, new species that are black in both sexes. Besides these species, *foliatae* Ashmead, *foliatae arizonica*, new variety, and *quinqueseptae*, new species, have this black form of male in addition to the lighter form. The black, or variety *dorsalis* type, of male of all these species is very similar and can not be positively distinguished to date. See discussion under *querci-lanae* var. *dorsalis* (Fitch), page 74.

31. Head almost or quite twice as broad as long, a small black spot contiguous with each ocellus, but these spots never confluent, occiput narrowly black, body almost immaculate golden yellow, anterior surface and groove of propodeum, peduncle and dorsum of abdomen, black, 11 or 12 setae on submarginal vein----- *pezomachoides* (p. 69).  
 Head about three-fifths as broad as long, 13 to 15 setae on submarginal vein----- 32.
32. Ocellar area not solid black, occiput narrowly black, head otherwise, and thorax almost, immaculate above and on sides, at times a suggestion or a patch of darker color along median line----- *subimmaculata* (p. 66).  
 Ocellar area usually solid black, black sometimes reaching beyond ocelli on all sides, at least prescutum mostly black, more often an irregular longitudinal dorso-median black band on at least mesothorax----- 33.
33. Usually a black triangle on, but not coextensive with, prescutum, rest of dorso-median area of mesothorax usually immaculate, sometimes black on males, dorsum of abdomen black, head four-sevenths as long as broad, sometimes almost twice as broad as long, 13 to 16 setae on submarginal vein.  
*pomiformis* (p. 70).  
 Usually an irregular longitudinal dorso-median black band on mesothorax, sometimes including pronotum, dorsum of abdomen black, head three-fifths as long as broad, 12 to 14 setae on submarginal vein----- *querci-lanae* (p. 72).

#### 1. *DECATOMA VACCINIICOLA*, new species

PLATE 1, FIGURE 1; PLATE 3, FIGURES 30, 31, 33; PLATE 4, FIGURES 35, 36, 40

*Decatoma nublistigma* ASHMEAD, Trans. Amer. Ent. Soc., vol. 14, p. 198, 1887 (misidentification).

*Decatoma varians* PROVANCHER, Additions à la faune hyménoptérologique, p. 194, 1889 (misidentification).

Recognizable by the yellow, more or less infuscated body, the usually dusky to black antennae, and the relatively long funicular joints, which are about one-third longer than broad in the female and twice as long as wide in the male. The submarginal band aids in recognizing the species. It resembles *D. flava* Ashmead and *D. nublistigma* Walsh most closely, but the above characters distinguish it from them.

*Female*.—Length 2.8 to 3 mm.; color mostly yellow to brown-yellow, in part sometimes golden brown; antennae smoky black, except that pedicel is yellow at apex, especially below, and scape and palpi are entirely light yellow; eyes pink, mandibles brown to black, ocellar area in part dark brown, rest of head dull yellow to light brown, in some specimens with more or less of the surface speckled dark brown or continuous dark brown; prothorax pale dull yellow with apex of scutel, lower part of scuto-axillar groove, and sternum,



somewhat black; metathorax and propodeum like the preceding segment, but propodeum darker above and below; legs a shade lighter than pronotum, femora tinged brown, with middle and hind tibiae brown, the latter darker; wings iridescent, stigma dark brown, submarginal band light brown and reaching three-fifths across the wing, its base narrower than length of stigma, widening toward apex but more sharply on the inner edge, the apex broadly rounded, secondary band exceedingly faint, practically wanting, petiole and abdomen more or less yellowish brown.

Head wrinkled-strigose, and finely and sparsely umbilicately punctate compared with punctures of thorax, genae sculptured like face, malar space more nearly smooth, vertex around ocelli finely punctate; head three-fourths as long as wide, and one-fourth broader than pronotum, occipital concavity approximately equal to facial convexity from above; flagellar joints moderately hairy, hairs about half the length of F2 and not definitely in whorls, facial vestiture more sparse and obscure; F1 twice as long as its mean thickness, F2 to F5 of equal width and length, each about a third longer than thick, first joint of club longer than second or third; nota of thorax coarsely umbilicately punctate, sparsely hairy, sclerites well rounded and parapsides fairly deep for the genus; mesopleura aciculate and finely punctate; pronotum definitely narrower than head and mesothorax; parapsidal and scuto-axillar grooves deep and entire; submarginal vein of fore wing with a row of 12 to 15 setae; abdomen, except the petiole, smooth, polished, shiny; segments 1 and 2 bare, 3 and 4 with a few hairs laterad, and apex of ovipositor sheath more densely clothed; petiole as long as segments 1+2, and segments 1 to 3 constituting about half the abdomen.

*Male*.—Length about 3 mm., color as in the female, but antennae at times almost yellow, yet tinged with brown, and most often dusky; face rarely speckled brown; secondary band of fore wings practically lacking, and apical fourth of abdomen infumated above; form somewhat more slender than female; head slightly more robust than in female, face strigose-punctate, malar space grooved as in female; F1 two and a half times as long as wide, F2 to F4 equal in length and thickness, and each twice as long as wide; 12 to 14 setae in the row on submarginal vein; abdomen polished, smooth, bare except apical fourth moderately hairy.

*Type locality*.—Dune Park, Porter County, Ind.

*Type*.—Female, U.S.N.M. No. 42232; allotype in the same collection.

*Paratypes*.—Ten females and 4 males on points, and 3 females dissected on slides, in the collection of the United States National Museum; 5 females and 5 males on points in the collection of the Illinois State Natural History Survey, Urbana, Ill.; 21 females on points and 11 dissected on slides, and 11 males on points in the

author's collection. This is a common species and has at times been mistaken for *D. nubilistigma* Walsh and *D. varians* Walsh.

*Remarks.*—All types reared indoors from May 5 to 10 by the author at Urbana, Ill., from stem galls on blueberry (*Vaccinium* sp.) collected April, 1927, by Dr. R. D. Glasgow in Dune Park, Ind. The species is also known as follows: 25 females and 16 males issued April 5 to 10 from stem galls on dryland blueberry (*V. vacillans*) collected March 19, 1922, by J. C. Bridwell in Rock Creek Park, Washington, D. C.; 8 females, labeled 4460, issued May 1, 1883, and the rearing records add that they were obtained from *V. nitidum* and received at the United States National Museum from J. G. Barlow, Cadet, Mo., April 13, 1883; 6 females and 2 males on multiple points labeled only "on *Vaccinium* (Bilberry), gall box 187"; 2 females on multiple points with data "Pol (polythalamous) gall on *Vaccinium pennsylvanicum*"; a series of 10 females and 6 males on three multiple-point mounts with record number 199<sup>so</sup>, from large galls collected by Mrs. Treat at the bases of small oaks in New Jersey; 5 females and 5 males bearing "No. 2," and three pins with data "ex galls on blueberry, Whites Bog, N. J., from B. F. Driggers"; 7 females from New Brunswick, N. J.; 1 female bearing record number 144 with data "J. L. Zabriskei, Nyak, N. J., Feb. 6, '84"; 3 females and 1 male on one mount, labeled "From Fitch's collection"; 6 females and 1 male reared by Dr. L. L. Huber, May 11, 1921, from galls of "*Solenozopheria vaccinii*" in New York; also a series bred by Dr. A. C. Kinsey from "*S. vaccinii*" at Forest Hills, Mass., as follows: May 9 to June 3, 1928, 7 females and 3 males; May 5 to 24, 1918, 5 females and 5 males. A series of 1 female and 7 males with the record number 323<sup>01</sup>, 24/484 and 323<sup>03</sup>, 24/484, came from a "cynipid gall on the roots of *Andromeda ligustrina* from Koebele, Holderness, N. H." Two specimens are labeled "Ottawa, Can.," and L. H. Weld sent me three females and a male that he reared from the kidney-shaped gall on stems of *Vaccinium* at Glencoe, Ill., on May 7, 1913. Mr. Weld deposited in the National Museum collection a series of 15 females and 8 males bred from galls on the same plant at East Falls Church, Va., on April 24, 1927.

The host gall of this chalcid was long believed to be formed by a species of Cynipidae, *Solenozopheria vaccinii* Ashmead,<sup>6</sup> but B. F. Driggers definitely demonstrated<sup>7</sup> that the maker of this common reniform swelling on the stems of "cultivated" highbush blueberry (*Vaccinium corymbosum*) is the chalcidoid *Hemadis nubilipennis* Ashmead, in whose gall *D. vacciniicola* lives.

<sup>6</sup> Trans. Amer. Ent. Soc., vol. 14, p. 149, 1887.

<sup>7</sup> Journ. New York Ent. Soc., vol. 35, pp. 253-259, 1927.

2. *DECATOMA FLAVA* Ashmead

PLATE 1, FIGURE 2; PLATE 4, FIGURES 39 and 42

*Decatoma flava* ASHMEAD, Can. Ent., vol. 13, no. 6, pp. 134, 135, June, 1881.—

TRIGGERSON, Ann. Ent. Soc. Amer., vol. 7, pp. 8-10, 1914.

*Decatoma catesbaei* ASHMEAD, Trans. Amer. Ent. Soc., vol. 9, p. xxxii, 1881.

Resembles *D. vacciniicola* Balduf in superficial appearance, but the eyes are less prominent, the antennal segments are yellow, and the funicular joints scarcely longer than broad; the whole body, except in part the propodeum and dorsal surface of abdomen, is yellow and unmarked with black or brown, the submarginal band is distinctly broader and darker brown, and the average specimen is larger in the present species. This is one of the most nearly yellow species of the genus.

*Female*.—Length 2 to 2.7 mm., head, thorax, and legs almost entirely yellow of various shades (greenish yellow in fresh specimens, Ashmead), except antennae, which are dull brownish yellow, sometimes metapleura more or less black below, hind femora on inner disk and hind tibiae on outer disk, deep brown; submarginal band medium to dark brown in newer material, faded light brown in Ashmead's paratypes, reaching two-thirds to hind edge of wing, proximal margin almost straight and apical margin broadly and uniformly rounded, sometimes more sharply dilated, these edges extending mostly beyond base of stigma and apex of stigmal vein respectively, apex truncate, also a definite narrow angular secondary band of the same color proximad of the main band; abdomen brownish yellow.

Length of head four-sevenths of width, barely convex behind, face distinctly produced and rounded transversely from above and sloping rather sharply downward and forward from the vertex, eyes but feebly set apart from face by marginal depressions, vertex moderately convex; pedicel slightly shorter than F1; F2 to F5 each slightly longer than broad, or as broad as long; antennae moderately hairy, hairs whitish; surface of front similarly hairy, front and genae reticulate-punctate, basal half of malar groove broad, rest narrow, malar space mostly finely wrinkled, ocellar area for most part very finely and densely punctate; pronotum distinctly narrower than head but nearly as broad as mesothorax at maximum width, these segments umbilicately punctate above, punctures of scutell coarser, mesopleura rather coarsely aciculate, and finely punctate; 13 or 14 setae on submarginal vein; lateral surfaces of abdomen very finely granulose, the dorsal surface sometimes less so.

*Male*.—Length 2.5 mm., slenderer than female; colored as female, but dorso-lateral area on each side of propodeal groove in front black, venter of propodeum with a small black area; submarginal band medium to dark brown, and secondary band definite; head, antennae, and thorax sculptured and clothed like female; F1 at least as long

as pedicel, and one-fourth longer than F2, latter only slightly longer than F3, this one as long as F4; F2 to F4 each not greatly longer than thick, club about as long as F3 and F4 combined, funicular joints about uniformly wide; fore part of abdomen smooth, but segments 3, 4, and 5 minutely roughened, granulose.

*Type locality*.—Jacksonville, Fla. (W. H. Ashmead).

*Type*.—Female, U.S.N.M. No. 25494.

*Paratypes*.—One female and one male paratype on slides in the writer's collection; other male paratypes and the allotype on points in the collection of the United States National Museum. Redescribed from several paratypes, and description checked with type, allotype, and other paratypes; bred from an oak gall doubtfully determined by Ashmead as *Cynips q.-ficus* Fitch—*Biorhiza forticornis* (Walsh), known as the oak fig gall. Kinsey, however, states that true *B. forticornis* is not known from Florida.

*Remarks*.—I am convinced that *D. catesbaei* Ashmead is identical with *D. flava* Ashmead. Both have been reared from galls of *Andricus* in Florida. *D. catesbaei* is represented by three females labeled in Ashmead's handwriting. The type has no submarginal band, while the paratype has a band in every respect like that of the typical *flava*. The third female has a poorly developed band, intermediate in form. In all cases the band is faint. Aside from this variable band, *catesbaei* and *flava* are alike. The *catesbaei* series seems to be abnormal in this wing character. No such variation in the wing band is known from any other species of this genus.

C. J. Triggerson reports rearing 600 of this species from the white-oak leaf galls *Cynips pezomachoides erinacei* (Mayr) [*Dryophanta erinacei* (Mayr)] as parasites of the gall maker. I have examined two specimens of this lot from Cornell University through the kindness of Dr. P. P. Babiý. Six females taken by Doctor Ashmead at Jacksonville, Fla., are labeled "*A. floridensis*" and "*H. omnivora*." They agree in all respects with the female paratype at hand and check also with all the other material of this species recorded here. *Andricus floridensis* (Beutenmueller) lives in a stem gall on the post oak (*Quercus stellata*) and its close relatives, according to Kinsey. This authority states further, in a letter, that "*H. omnivora* is a *Disholcaspis* ordinarily considered a variety of or synonymous with *D. globulus* or *D. mamma*." He adds that *globulus* or *mamma* does not range into Florida.

I have received the following reared specimens from L. H. Weld: 1 female (Weld No. 21) from the gall of *Callirhytis seminator* (Harris) on white oak (*Quercus alba*) at Evanston, Ill.; 2 of each sex (Weld No. 640) from the galls of *C. tubicola* (Osten Sacken) on *Q. stellata* at Ironton, Mo.; 1 of each sex (Weld No. 820) from the gall of *Andricus tubularius* Weld on *Q. undulata* at Tijeras, N. Mex.;

2 of each sex (Weld No. 131) from the galls of *Acraspis macrocarpae* Bassett at Evanston, Ill.; 3 females and 1 male from the woody form gall of *Neuroterus noxiosus* (Bassett) on swamp white oak (*Q. bicolor*) at Evanston, Ill.; 4 females and 2 males from the gall of *Acraspis macrocarpae* Bassett at the same place; 1 female and 2 males from the gall of *Andricus murtfeldtae* Ashmead on *Q. stellata*, East Falls Church, Va.; and the same collector deposited in the United States National Museum 3 females and 2 males (Hopkins U. S. 15634<sup>c</sup>), all only 2 mm. long and with apex of scutel and the propodeum in part black, from the galls of *Compsodryoxenus humilis* Weld on *Q. chapmani*, June 30, 1920, at Ocala, Fla.

In the United States National Museum are also 6 females and 4 males that can not be separated from *flava* Ashmead except by size. But all grades of size occur in the material of different lots before me. The present 10 specimens were reared by Theodore Pergande on June 16–21, 1883, from galls of *Neuroterus batatus* (Fitch) on *Q. alba*, in Virginia. R. A. Cushman reared a female and two males (Quaintance No. 7173) from an oak gall at Vienna, Va., August 16, 1911. The males are of special interest because they have more black above on the thorax than the average individual of this sex. A series of 11 females and 9 males (No. 2251) are small but otherwise not distinguishable from *flava*. The galls from which these came were not identified, but the following description of them remains in the records of the Museum: "These galls are sometimes on the leaf stem and connected with the main twig, sometimes on the leaf but always entirely deforming the leaf. They have a compound appearance like a coalescence of several buds, shape irregular but usually globular." They were received at Washington, D. C., on June 20, 1880.

Dr. A. C. Kinsey sent 4 females and 7 males from galls of *Neuroterus batatus noxiosus* form *noxiosus* (Bassett) on stems of *Q. bicolor* at Waterbury, Conn. These specimens were a part of the collection of Homer F. Bassett. Another series, 19 females and 3 males, were received from Doctor Kinsey, who reared them from the galls of *Andricus aciculatus* Beutenmueller on *Q. stellata* at Yoakum, Tex., the gall makers having been reared November 30, 1919. I also have 12 females and 5 males reared by Kinsey at Forest Hills, Boston, Mass., in 1919 from the galls of *Cynips (Acraspis) pezomachoides* Osten Sacken, which makes its galls on *Q. alba*. The specimens from the latter galls are as a whole distinct from all other *flava* at hand, but the differences are only in the color, which is generally darker. Their form, proportions of the antennal joints, sculpturing, vestiture, and wing bands are in all respects like the typical *flava*. One male, reared by Dr. L. L. Huber at Bluffton, Ohio, on April 12, 1921, from the

same gall on *Q. alba* is plain yellow, like the *flava* from Florida and Texas. The Kinsey specimens from Forest Hills are therefore at best only color varieties of *flava*.

I also have two females received through Doctor Kinsey and reared by Dr. J. T. Patterson at Austin, Tex., from the galls of *Andricus murtfeldtae* Ashmead on *Q. breviloba*.

Three females in the National Museum collection were reared at Alexandria, Va., on June 17 from the galls of *Andricus floridensis* (Beutenmueller) on *Q. digitalis*. The generally darker body, particularly the black propodeal groove, the brown abdomen, and the deep brown of the submarginal band of these specimens may justify their recognition as a geographic variety if additional material proves that these color variations are constant for specimens from that region.

One female cut from the gall of *Andricus quinqueseptum* var. from Marco, Lee County, Fla., April 21, 1912, came to me through Doctor Kinsey, who determined the gall, from the American Museum of Natural History and bears record number F.626.Acc.3973. One female (record No. 66<sup>501</sup>) reared on June 28, 1883, from the gall of *Disholcaspis globulus* (Fitch) (*Cynips q.-globulus*), collected at Providence, R. I., on April 7, 1883, by A. T. Packard, checks with the types. A single female was taken at Lafayette, Ind., by Dr. F. M. Webster.

### 3. *DECATOMA QUERCI* Ashmead

*Decatoma querci* ASHMEAD, Can. Ent., vol. 13, no. 6, p. 135, June, 1881.

The status of this species is in doubt, for there is no type material and a male labeled *Decatoma querci* Ashmead, in what is perhaps Ashmead's handwriting, does not agree with the original description. Particularly the head of this male is yellow, whereas Ashmead said "vertex inclosing ocelli brownish black." This specimen compares favorably with *flava* Ashmead. Ashmead raised his material "from a dipterous gall on *Quercus catesbaei*"—*Quercus laevis* Walter—at Jacksonville, Fla., but does not give further facts about the gall. Most oak-inhabiting species of this genus are from cynipid galls. It is possible that *Decatoma* from dipterous oak galls may be distinct from those in cynipid galls on the same oak species. I, therefore, am inclined to recognize the present species at least tentatively in the hope that new material may be reared from dipterous galls on *Q. laevis* that may agree with Ashmead's description of *querci*, and prove this to be a good species.

The essential features of the original description of *D. querci* by Ashmead are here reprinted:

*Male*.—"Length 0.12 inch. Head green, slightly yellowish and coarsely punctate, vertex inclosing ocelli brownish black, \* \* \* gula black; antennae \* \* \* pubescent, greenish yellow, third joint dark; thorax coarsely punctate and slightly hairy; collare

\* \* \* broader than mesonotum, greenish yellow, with a slightly darker transverse band of brown in center; mesonotum, scutellum and metathorax dark reddish brown \* \* \*; abdomen smooth, shining black or brownish black, more or less of a reddish brown anteriorly, peduncle two-thirds as long as abdomen, black; \* \* \* stigma black, with a brownish black blotch extending from it to more than half way across the wings; legs, anterior pair greenish yellow, middle tibiae infuscated, posterior tibiae brownish black, tarsi black.”

It is not known how many specimens were used in preparing this description, but presumably they were few. If this species should prove to be variable in color, as is common in the genus *Decatoma*, entire agreement with this description can not be expected even should new specimens become available.

#### 4. *DECATOMA LANAE* Ashmead

PLATE 1, FIGURE 3; PLATE 3, FIGURE 32; PLATE 4, FIGURE 33

*Decatoma lanae* ASHMEAD, Can. Ent., vol. 13, no. 6, p. 135, June, 1881.

Similar to *D. vacciniicola* Balduf in being mostly yellow, but the female differs in having F2 to F5 as broad as long, and the male with the funiculars only about one-third longer than thick; anterior half of scutel black, abdomen infuscated above, the submarginal band shorter, more narrow, margins less entire, and its apex distinctly curved toward base of the wing.

*Female*.—Length 2.2 to 2.5 mm., mostly yellow and light orange; antennae honey yellow, base of pedicel brown above; head dull yellow; mandibles, ocellar area in part, and occiput dark; pronotum concolorous with yellow of head, rest of thorax and the propodeum light orange, except front of scutellar disk, sterna, metanotum mostly, and middle half of propodeum on anterior third and groove, almost black; legs yellow, only hind tibiae brownish black; submarginal band medium brown, embracing only base of stigmal vein, mostly narrower than length of stigma, its margins somewhat irregular, its proximal edge concave, apical side more convex and sometimes with a heellike mesal prominence, apex bluntly pointed, reaching slightly beyond middle of wing, secondary band lacking on all specimens at hand; peduncle in part black, abdomen light brown, dorsum infuscated.

Head almost two-thirds as long as wide, eyes not prominent, their juncture with face only feebly interrupted; face strigose-punctate, cheeks and malar space obscurely punctate or smooth, and ocellar area and sometimes adjoining part of vertex minutely punctate; scape almost thrice as long as pedicel, F1 one-third longer than wide, F2 to F5 each not longer than broad, or slightly shorter than wide, each succeeding joint slightly wider than the preceding, antennae more densely hairy than head and thorax, hairs not conspicuous;

prothorax only slightly narrower than head and mesothorax, these segments umbilicately punctate above, mesopleura aciculate and finely punctate; a row of about 12 setae on submarginal vein; abdomen more or less finely granulose.

*Male*.—Similar to the female, but with the first flagellar joint twice as long as broad, as long as pedicel; second, third, and fourth flagellar joints all longer than broad but shorter than the first; abdominal petiole longer than hind coxae; vertex except narrow line at eye margin and broad transverse stripe behind, occiput, large quadrate spot on pronotum dorsally, prescutum, median posterior angles of scapulae, scutellum dorsally, propodeum dorsally, metasternum, large spot on inner face of hind coxae, inner side of hind femora in part, hind tibiae on outer side except at base, front femora in part, and petiole of abdomen above and below but not laterally, black. Abdomen beyond the petiole piceous.

*Type locality*.—Jacksonville, Fla.

*Cotypes*.—Nine females and two males, U.S.N.M. No. 2818.

*Remarks*.—One of the females on a point, and two dissected on slides, are retained in the writer's collection. All are labeled "Jacksonville, Fla., Collection Ashmead." This species was originally described from numerous specimens of both sexes reared by Doctor Ashmead from the woolly gall of the cynipid *Andricus turnerii* (Ashmead) (*Cynips q.-turnerii* Ashmead) on *Quercus aquatica*, Jacksonville, Fla. I find also in the collection of the National Museum three females from Duval County, Fla., one female labeled "E. Fla., Ashmead," and seven females without data.

##### 5. DECATOMA AMSTERDAMENSIS Girault

###### PLATE 1, FIGURE 4

*Decatoma amsterdamensis*, GIRAULT. Descriptiones stellarum novarum, p. 10, 1917.

Similar to *flava* Ashmead; has occiput, anterior dorsal portion (the part telescoped into the prothorax), lower part of axillae, metanotum mostly, anterior third and groove of propodeum, sterna of thorax, top of abdominal segments in part, black contrasting sharply with the yellow; middle and hind tibiae brown; abdomen yellowish brown on the sides and submarginal band more faint; head, thorax, and legs otherwise one shade of lemon yellow.

*Female*.—Length, 2.4 mm., relatively more slender than most species, colors predominantly yellow with scattered patches of black; head deep lemon yellow, mandibles brown, ocelli bordered or partly to entirely inclosed with small black blotches, occiput narrowly black; scape light yellow, basal third of pedicel brown, rest yellowish,



flagellum light brown; pronotum uniformly concolorous with head, except sternum, which is black; mesothorax deeper yellow, anterior portion and sometimes entire front edge under pronotum, lower portion of axillae, and sternum, black; submarginal band faint light brown, stigma darker, band extending two-thirds across wing, narrower than length of stigma, stigmal vein not involved in band, proximal margin almost straight, slightly oblique basad, distal margin broadly rounded, apex rounded, secondary band lacking; metathorax mostly black, propodeum likewise on anterior third, on groove and sternum, rest yellow; coxae to femora yellow like head and pronotum, tibiae darker yellow, tarsi of middle and hind legs more or less brown; petiole black and yellow, abdomen brownish yellow, except top and end of ovipositor sheath, which are brown to black.

Head slightly more than half as long as wide, forehead rising sharply above inner margins of eyes; cheeks, labrum, and malar space smooth, rest of head strigose wrinkled, moderately punctate, except anterior part of ocellar area, which is finely punctured, all the parts of the head moderately and inconspicuously hairy; scape as long as pedicel, F1 and F2 combined, F1 slightly shorter than pedicel and a fourth longer than F2; F2 to F5 subequal in length and broadening gradually toward club, each slightly longer than broad, the last barely so, club nearly as long as F3 to F5 combined and somewhat blunt, flagellum moderately hairy, hairs whitish; thorax coarsely punctured above like the head, and similarly hairy, prothorax more than half as long as broad and about as wide as mesothorax; mesopleura aciculate and finely punctate; submarginal vein bearing a row of 11 or 12 setae; apical half of abdomen sparsely hairy, sheath of ovipositor moderately so, surfaces of segments smooth, shining.

*Male*.—Length, 2.3 mm., slenderer than female; color, proportions, sculpturing, and vestiture in general like those of female, except as follows: Anterior margins of mesonotum (under pronotum) its entire width, and most of propodeum, black; scape not reaching middle of F2, pedicel slightly shorter than F1, F2 slightly longer than F3 and F4, latter equally long and nearly a half longer than thick and barely wider than F1 and F2, club slightly broader than F4.

*Type locality*.—Penn Yan, N. Y.

*Type*.—Female, U.S.N.M. No. 20246.

Redescribed from the type, the allotype, two male paratypes, and a series of the original specimens of both sexes, all reared by Dr. W. J. Phillips at Penn Yan and Auburn, N. Y., in 1915 in connection with his study of *Harmolita* (*Isosoma*). These specimens bear Webster No. 9355. Three older specimens, two females and a male, on one card are labeled "Parasit No. 6, *Isosoma hordei*."

## 6. DECATOMA TEXANA, new species

## PLATE 1. FIGURE 5

Very similar to *D. flava* Ashmead in color and sculpturing, but is smaller than most specimens of *flava*, the propodeum is largely or entirely yellow, and the whole vertex is minutely and densely punctate.

*Female*.—Length 1.5 mm., body and legs almost entirely yellow to yellowish brown; head uniformly light yellowish brown, borders of ocelli in part not so, scape and pedicel light yellow, latter deeper, funicular joints slightly darker than pedicel, and club dull medium brown; prothorax uniformly deep lemon yellow, mesothorax and propodeum concolorous with head, faintly suffused dark above; legs colored like prothorax, except that inner faces of femora are dark brown, hind femora still darker, outside of middle tibiae narrowly, and of hind tibiae mostly, brown; submarginal band medium brown, two-thirds as broad as long (not including stigma), quadrangular, corners rounded, proximal portion extending four-fifths across wing and moderately convex, distal edge reaching well beyond end of stigmal veins and almost straight, apex broadly rounded; secondary band well developed; abdomen deeper yellowish brown than mesothorax.

Head three-fifths as long as wide, facial outline from above broadly and uniformly rounded, vertex feebly convex transversely, receding sharply behind ocelli, eyes and surrounding parts continuous, not sharply demarcated, occiput slightly concave, malar space and cheeks smooth, mostly bare, rest of head moderately hairy and wrinkled-strigose, moderately punctate, except vertex, which is finely and densely punctate, scape as long as pedicel, F1, and F2 combined, more than twice as long as pedicel, latter one-third longer than F1, F1 about one-sixth longer than F2, F2 to F4 broadening slightly toward club, F2 and F3 as broad as long, F4 and F5 broader than long; prothorax distinctly narrower than head, scarcely broader than mesothorax, pronotum and mesonotum coarsely but shallowly sculptured with umbilicate punctures, rather shiny and inconspicuously and sparsely hairy; 10 or 11 setae on submarginal vein, surface vestiture faint just distad of submarginal band, coarser and more obvious beyond; sides of abdomen well rounded, surface smooth, polished, posterior face and sheath of ovipositor moderately hairy.

*Male*.—Like the female, except for the usual secondary sexual differences in the antennae and the abdomen. F2 to F4 are about one-fourth longer than broad.

*Type locality*.—Brownwood, Tex.

*Type*.—Female, U.S.N.M. No. 42233.

Described from five specimens, the type and a female paratype on points in the collection of the United States National Museum, the allotype and the other two paratypes on slides in the writer's collection. It is possible that this is a small, lighter-colored form of *D. flava* Ashmead, but it seems sufficiently distinct to be a separate species.

7. *DECATOMA DISHOLCASPIDIS*, new species

PLATE 1, FIGURE 6: PLATE 3, FIGURE 34

Resembles *D. flamminneiventris* Girault in size and form, but is easily distinguished from it by the absence of the broad black mid-dorsal thoracic band, the shape of the submarginal band, and the presence of the usual longer hairs on the wing surface; still more like *flava* Ashmead in color, differing chiefly in having a much broader submarginal band sometimes greatly dilated on both its lateral margins.

*Female*.—Length 3.1 mm., rather robust in form; the head and thorax, including propodeum, reddish brown with a tinge of yellow, except as follows: A narrow circumocular band and antennae honey yellow but on more mature specimens medium brown, occiput lighter, approaching pronotum in color, each ocellus partly inclosed in a small dark blotch, on one specimen a faint dark band extending from each lateral ocellus to antennal scrobe; prothorax light brownish yellow, scutellum feebly infusate or disk with a blotch of black, a patch on either side of anterior end of propodeal groove, and sternum of thorax and propodeum in small part, black; front and middle coxae yellow, lighter than pronotum, hind coxae darker and concolorous with femora, but lighter than mesothorax, middle and hind femora more or less black on inner face, and hind femur slightly infusate on outer face also, tibiae light yellowish brown except outer face of front tibiae lightly infusate at base, and of middle and hind tibiae entirely brown and black respectively, tarsi honey yellow; submarginal band dark brown, to light brown as in *flava* Ashmead, diverging from stigma, the proximal margin slightly and the distal margin sharply rounded or at an angle of 45° from end of stigmal vein for half the length of the band, then sharply rounded toward its apex, apex very broadly rounded, maximum width of band almost equal to length, extending on proximal side five-sixths across the wing, or both margins almost equally moderately convex, one-fifth longer than wide, jug-shaped, secondary band amber-colored and faint; abdomen light yellowish brown ventrally, becoming darker dorsad and more or less deeply infusate above.

Head slightly more than half as long as broad, front only slightly convex, vertex only slightly elevated above the eyes, temples not prominent, occiput feebly concave, outline of head

above therefore subrectangular-ovate, surfaces moderately and inconspicuously hairy, finely wrinkled and with occasional shallow umbilicate punctures, more or less of vertex minutely and shallowly pitted, one female with a few umbilicate punctures in ocellar area, malar space smooth and bare; pedicel one-sixth longer than F1, joints F2 and F3 about equal, one-fifth longer than wide, F4 and F5 slightly shorter but a little thicker than the preceding, and only a little longer than broad; head slightly broader than mesothorax, and both these distinctly broader than pronotum; 13 to 15 setae on submarginal vein; abdomen very finely and uniformly granulose, except first segment and venter, which are in part polished, smooth; sparsely to moderately hairy posteriorly.

*Male*.—Size, vestiture, sculpturing, and color as described for female, except that mesothorax is light brownish yellow, the scutellum partly black as in the female to wholly concolorous with prescutum, and propodeum almost entirely like the mesothorax to black as in the female, and in one specimen the groove also black; F1 as long as pedicel and a fourth longer than F2, F2 to F4 broadening and shortening slightly toward club.

*Type locality*.—Austin, Tex.

*Type*.—Female, U.S.N.M. No. 42234.

*Remarks*.—Described from the type, allotype, and two female and two male paratypes, the type and allotype in the collection of the United States National Museum, the rest in the writer's collection. These were reared by Dr. A. C. Kinsey from the galls of *Disholcaspis cinerosa* (Bassett) on live oak (*Quercus virginiana*) collected in the type locality. The gall makers issued December 4, 1919. Some wings and antennae of both sexes are on slides. In the collection of the National Museum are four females and one male on slender pins with label "Texas, Belfrage." The hind edge of the submarginal band is not so much produced as in the type specimens. It is also represented by several Hopkins lots, as follows: Two females (Hopk. U. S. 15637<sup>b</sup>), September 29, 1922, reared by L. H. Weld, presumably from galls on *Q. pungens*, at Tijeras, N. Mex.; 3 females (Hopk. U. S. 15637<sup>d</sup>), reared by Weld, October 2, 1922, from the same locality and oak, and the gall is an undescribed *Disholcaspis* (determined Weld); 1 female and 2 males (Hopk. U. S. 15604<sup>a</sup>), by Weld, Prescott, Ariz., April 25 and 30, and May 8 (1 female), 1918, presumably from galls, on *Q. grisea* or *Q. arizonica* (evergreen oaks); 9 females and 3 males (Hopk. U. S. 15604<sup>c</sup>), L. H. Weld, Prescott, Ariz., May 15 to August 1, 1918, from galls of *Callirhytis ruginosus* (Bassett) on *Q. grisea* and *Q. arizonica*; 2 females and 1 male (Hopk. U. S. 13687<sup>c</sup>) reared July 12, 1918, from galls determined by Weld as *Adleria*, on *Q. oblongifolia*, at Esparara Cañon, Ariz.; and 1 male (Hopk. U. S. 10773<sup>w</sup>), reared June 11, 1919,

by J. H. Pollock, at Colorado Springs, Colo., presumably from galls, on *Q. gambelii*. These Hopkins materials for the most part have the wing band somewhat less expanded on the sides than those of the types, but are obviously the same species. All the material of this species at hand to date is from the Southwestern States—Texas, New Mexico, Arizona, and Colorado—and judged by the degree of development of the wing band, this species has evolved farthest in the type locality. The specimens from the more northern and western States approach *D. flava* Ashmead, from which *disholcaspidis* differs only in the enlarged submarginal band.

#### 8. *DECATOMA MIMOSAE*, new species

Nearest to *D. flava* Ashmead in having the body almost entirely yellow, but differs from it in being somewhat smaller, in having the distal margin of the submarginal band more strongly produced and rounded and noticeably more constricted necklike at the stigmal vein, and in the possession of only 9 to 11 setae on the submarginal vein.

*Female*.—Length, 2.4 mm., almost entirely golden or yellowish brown; head entirely golden brown or lightly infuscate, ocelli reddish, antennal scrobe ochreous-yellow, scape light yellowish brown, pedicel medium to darker brown, its apex above lighter, F1 and club moderately dark brown, rest of funicle distinctly lighter brown; prothorax golden yellow, mesonotum light reddish brown tinged with yellow, disks of scapulae and axillae faintly brown, mesopleura concolorous with pronotum, groove and upper anterior portion of propodeum brown black; legs mostly a shade lighter than mesopleura, hind femur faintly brown on outer disk, middle and hind tibiae medium brown or dusky on outer faces, tarsi stramineous; submarginal band medium light brown, the stigmal vein conspicuously dark brown through the stigma, band with a prominent neck, or outer basal shoulder of band widely separated from free portion of stigmal vein, distal margin rather sharply rounded and reaching distinctly beyond apex of stigmal club, proximal margin straight and slightly distad of base of stigma, band about a fourth longer than its maximum width; peduncle and abdomen varnish brown, lightly tinged yellow, the venter feebly lighter, slightly darker on the middle above than on sides.

Head three-fifths as long as wide, front fairly prominent transversely above antennal fossae, broadly and uniformly rounded, occiput rather strongly concave, eyes and front not sharply set off at their juncture; small areas behind anterior and laterad of posterior, ocelli only finely punctate, rest of ocellar area moderately umbilicately punctate, punctures smaller and more shallow than on thorax, more numerous on occiput and antero-laterad of ocelli, cheeks

coarsely strigose, polished, malar space finely strigose, face to oral region inconspicuously reticulate-umbilicate punctate; scape about five times as long as its maximum thickness, pedicel almost a fifth longer than F1, this joint only slightly longer than F2, F2 barely longer than F3, F4, and F5, and slightly longer than broad, the other funiculars as broad as long, or F5 a bit broader than long, club relatively short and thick; head one-sixth wider than pronotum, width of mesothorax intermediate, but nearer that of head; nota of prothorax and mesothorax umbilicately punctate, the interior part of latter finely wrinkled as usual where overlapped by hind portion of pronotum, mesopleura aciculate, the posterior half less conspicuously on posterior two-thirds; anterior carina of propodeal furrow forming a moderately diverging U, furrow bottom with several broken, crooked rugae, lateral and anterior faces of propodeum distinctly reticulate, mesal portion less so; submarginal vein with a row of 11 setae (one specimen); abdomen mostly bare, moderately hairy behind, surface highly polished, unsculptured, glassy transparent.

*Male*.—2.3 to 2.4 mm. long, colored like female, mesal surfaces of propodeum as reticulated as lateral surfaces, submarginal vein bearing a row of 9 to 11 setae, sculpturing and vestiture as in female, dimensions of head the same; scape five times as long as greatest diameter near base, pedicel one-fifth longer than F1, latter one-eighth longer than each of F2, F3, and F4, each of these two-sevenths longer than broad, club three times longer than broad, and as long as F4, F3, and a fourth of F2 combined.

*Type locality*.—Huachuca Mountains, Ariz.

*Type*.—Male, U.S.N.M. No. 42241.

Beside the type, there are at hand the female allotype and one male paratype, the latter two in the writer's collection. All the material was received from Lewis H. Weld, who reared it from a woody stem gall on *Mimosa biuncifera*. The pins bear Weld's record number 375.

#### 9. DECATOMA NUBILISTIGMA Walsh

##### PLATE 1, FIGURE 7

*Decatoma nubilistigma* WALSH, Amer. Ent. and Bot., vol. 2, no. 10, p. 301, 1870.

Resembles *D. flava* Ashmead somewhat in length, size of head, in the number of setae on the submarginal vein, and in being largely yellow. *D. nubilistigma* has the head, vertex, prescutum, scutel, and propodeum more or less black, a somewhat smaller wing band, and the yellow of the body is a lighter shade than in *flava*, which is almost entirely yellow of a golden hue.

*Female*.—Length 2.5 to 2.8 mm., colors various shades of yellow and black; head greatly variable from entirely ochreous-yellow, ex-

cept disk slightly beyond ocelli and occiput, which are more or less black, sometimes lower hind edge of genae more or less black, and on several specimens the black spot of vertex merging caudad with occipital black area, also proceeding over the front below antennal fossae, the frontal black not solid, side margins of antennal scrobe and ocular space narrowly yellow; scrobe yellow, scape lemon yellow, sometimes with a cloudy black stripe on exterior lateral face, pedicel brown at base and sometimes above, otherwise yellow, flagellum reddish brown to light fuscous above, or quite uniformly yellowish brown; pronotum mostly ochreous-yellow, barely lighter than yellow of head, a discal dark brown spot, reaching anterior and posterior margins on one specimen, and almost lacking on another, mesothorax ochreous-yellow or rufous-yellow, disks of prescutum and scutellum always brown-black, their margins usually narrowly yellow, or dark to margins on one specimen, hind margin of scutellum always so, tops of scapulae and axillae with varying degrees of brown, but immaculate on the type, parapsidal and scutello-axillar grooves never darkened completely; metathorax, except pleura, and lateral and posterior surfaces of propodeum somewhat variously, ochreous-yellow; legs mostly lemon yellow, posterior coxae with an exterior longitudinal black stripe, femora each with a superior black stripe, never including entire aspect, and not much larger or intense on hind than on front femora, fore tibiae immaculate or faintly dusky, middle and hind tibiae dark brown outwardly, somewhat more extensively and densely on hind legs; submarginal band light brown, almost amber, faint in all the specimens at hand, slightly broader than length of stigma, about a half longer than wide, distal margin broadly rounded, this edge scarcely extending beyond apex of stigmal vein and feebly dilated at the middle, not parallel with proximal margin, the sides converging to blunt terminus, secondary band almost imperceptible; petiole ochreous-yellow, dorso-median line broadly, sides and venter sometimes dark brown, abdomen mostly yellowish brown, a poorly demarcated dark-brown angular band above but first segment almost entirely immaculate, and one specimen with entire posterior half of abdomen brown black.

Head on average slightly less than four-sevenths as long as wide, face from above not broadly and uniformly rounded, but almost forming a straight transverse line as seen from above, occiput less than moderately concave; several small umbilicate punctures behind anterior ocellus, these more numerous on occiput; genae bare, smooth, shiny; malar space coarsely strigose below groove, finely strigose above mesad of groove, front with shallow, inconspicuous, and rather large hair-bearing reticulations, hairs whitish, sparse; antennae moderately stout, pedicel a fourth longer than F1, F2 to F5 equal in

length, each one-sixth longer than thick, club as long as F5, F4, and half of F3 combined; head one-ninth wider than pronotum and barely broader than mesothorax, side of pronotum papillose wrinkled, mesopleura aciculate, except lower half of the posterior sclerite, which is feebly or not at all so; parapsidal grooves quite deep; anterior of propodeal groove limited by a broad V-shaped carina, its apex very obtuse, groove deep and polished on front fourth, the rest subreticulate, other surfaces of propodeum coarsely reticulate, more coarsely so along groove; 11 to 15, more often 12 to 14, setae in row on submarginal vein, hairs at times more closely set; fourth abdominal segment with a few hairs in a transverse row above, ovipositor sheath more hairy, abdomen otherwise bare, all segments perfectly polished and shining.

*Male*.—Length 2.2 to 2.5 mm.; the males at hand agree with the females that have the head all yellow except the vertex and occiput. The black on the thoracic nota varies as in the female, but the legs of all the males are distinctly more nearly entirely yellow, only the hind tibiae being darkened outwardly on two specimens and the third has the second tibiae brown also, but feebly; males otherwise like female, except antennae; scape four times as long as major thickness, reaching almost to middle of F2, pedicel and F1 very nearly same length, F1 one-fifth longer than each of F2 to F4, latter almost equal in diameter, F2 five-eighths as thick as long, F3 and F4 each successively slightly thicker, club about same in diameter as funiculars, tapering slightly to a blunt tip, and as long as F4. F3, and a fourth of F2 combined.

*Type locality*.—Probably Rockford, Ill. (Dr. B. D. Walsh).

*Cotype*.—Male, U.S.N.M. No. 1536 (through A. Bolter, 1890).

Redescribed from the Manitoba and Fitch specimens referred to below, and checked with the cotype in the United States National Museum. Fragments of a female cotype remain in the latter collection.

*Remarks*.—A series of five females and one male belonging to the Canadian national collection were reared by Norman Criddle from galls on a willow on June 10, 1906, at Aweme, Manitoba; two females from Hull in the same collection without host data check well with the description by Doctor Walsh, except that the wing bands of the original material were pale fuscous, whereas the Criddle specimens, as well as two males from Fitch's collection, have pale brown bands, which difference might be due to fading through time. The Fitch specimens bear numbers 10185 and 15224, respectively, and one bears information indicating that they came from willow galls.

It is unlikely that one species of *Decatoma* inhabits galls on plants of such diverse relationship as willow and oak. Doctor Walsh in describing this species had before him material from a cecidomyioid



willow gall, *Rhabdophaga batatas* (*S. batatus* Walsh) and from "an undescribed gall" on swamp white oak (*Quercus bicolor*) which, he states, was "in all probability cynipidous." I have found no means of determining what the oak gall inhabitant is. None of the original specimens is at hand, and the Walsh description brings out no characters that serve as a basis for separation. I am here regarding the *Decatoma* from willow as having priority right to the name *nubilistigma*, and believe that the species from swamp white oak will prove to be distinct from it when it is rediscovered. I have no *nubilistigma*-like material from the oak, hence it has probably not already been described under another name.

10. *DECATOMA BICOLOR* Ashmead

PLATE I, FIGURE 8

*Decatoma bicolor* ASHMEAD, TRANS. AMER. ENT. SOC., vol. 9, p. xxxii, 1881.

Similar to *D. lanæ* Ashmead in having F2 to F4 of female as broad as long, but distinguishable from it by its darker body and legs, and the longer, broader, and almost rectangular form of the submarginal band.

*Female*.—Length 2.5 mm., mostly yellowish brown to dark or reddish brown; antennae medium brown, pedicel yellow, scape intermediate between flagellum and pedicel in color; head, thorax, and propodeum a mixture of yellow and brown and lightly infuscated above, except pronotum is more nearly brown-yellow, and propodeal groove and area along anterior margin are black; all femora and fore tibiae mostly reddish brown, hind tibiae mostly brownish black, legs otherwise largely yellowish brown; submarginal band dark brown, extending two-thirds across the wing and about two-thirds as wide as long, proximal margin concave, irregular, distal edge almost entire and broadly rounded and reaching, sometimes strongly, beyond apex of stigmal vein, secondary band exceedingly faint, practically lacking; abdomen deep reddish brown and infuscated.

Head from above robust, its length about four-sevenths of its width, about as broad as mesothorax and slightly narrower than prothorax, hind edge almost straight, eyes on almost the same contour level as face, their margins not deeply depressed, head surfaces coarsely reticulate-punctate to strigose, intervals of reticulations sparsely and finely roughened, vertex, chiefly around ocelli, both umbilicately and finely punctate; antennae relatively thick, broadening distinctly from pedicel to first segment of club, F1 scarcely longer than broad, F2, F3, and F4 as long as broad, hairs coarse and partly overlapping next joint; thorax umbilicately punctate.

tate above, punctures contiguous, larger on scutel, mesopleura aciculate and finely punctate, the silvery bunch of hairs conspicuous on metapleura; about 13 setae on submarginal vein; abdomen bare except that ovipositor sheaths and last segments are moderately to sparsely hairy, entire tops and sides of the segments shagreened.

*Male*.—Unknown.

*Type locality*.—Jacksonville, Fla.

*Type*.—Female, U.S.N.M. No. 2820.

Redescribed from type and four female paratypes from the same locality as the type. One of the paratypes is in the writer's collection on a slide. The species was originally described from five female specimens; "four captured at large and one bred from cynipidous live oak root gall *Dryorhizoxenus floridanus* Ashmead" by Doctor Ashmead. Three other old specimens, two labeled "Jacksonville, Fla.," may be this species.

*Remarks*.—No additional material of this species has been collected. I suspect that this may be identical with *D. flava* Ashmead, but am allowing it to stand as distinct until further specimens can be obtained from the above host. The types differ from *flava* in being darker in body color, but this seems to be an abnormal or perhaps tarnished color shade. The wing band of most specimens of *bicolor* bulges more on the distal margin than on *flava*. Furthermore, the unique type of gall from which some of Ashmead's specimens were obtained strengthens the probability that they are a distinct species.

#### 11. DECATOMA ISIS Girault

##### PLATE 1, FIGURE 9

*Decatoma isis* GIRAULT, *Descriptiones stellarum novarum*, pp. 10–11. 1917.

From the same genera of Cynipidae as *D. varians* Walsh, and has a "bottle-shaped" submarginal band like that species; *isis* differs in being larger, darker on the average, in having slenderer antennae, in having 15 to 18 setae on the submarginal vein, and the head almost twice as wide as long, or nearly the shape and dimensions as on *D. dubia* Walsh.

*Female*.—Length 3.3 to 4.6 mm.; colors chiefly black and rufous-yellow, variable; vertex usually mostly black, but at least band along eyes and oblique stripe from it to top of antennal scrobe reddish yellow, occiput at times almost entirely black but usually in part not so, temples and cheeks largely black with at least hind edge black, malar space and front varying extremely from entirely rufous or reddish yellow to mostly black, margins of eyes and antennal scrobe, region of mouth to lower end of scrobe, and malar groove usually not black; scape dull yellow, pedicel mostly brown, apex yellowish, funicle chestnut-brown, club darker; pronotum

golden reddish brown, except a black mesal area usually about as broad as length of this segment, or less often not black in front but with a pair of black projections reaching close to front edge of segment, or black area in form of a triangle, its apex cephalad; prescutum entirely black, and scutell mostly so, its sides not so. scapulae and axillae sometimes entirely black above, but sides always more or less reddish brown, mesopleura the latter color, tegulae yellowish brown, propodeum mostly black, sometimes in part reddish on sides and above; legs mostly light yellowish brown, coxae usually so but at times more or less black on posterior faces, front femora sometimes unicolorous or with a superior black stripe, middle and hind femora generally darker, the former at times almost entirely yellowish brown and again more or less dark brown, the latter on the average with more dark brown, its outer face varying from yellowish brown to rarely entirely black; tibiae mostly dark brown or black, front tibiae with outer face only, but middle tibiae more so, and hind tibiae entirely so except base and apex; tarsi usually light yellowish brown, but hind tarsus rarely lightly infuscate behind; submarginal band dark brown, form variable from about twice as long as wide to only one-fourth longer than wide, more often the former and then proximal edge moderately concave and distal edge sometimes about parallel with it or sometimes somewhat dilated below stigmal vein and more sharply rounded, length of band about two-thirds the width of the wing at that point; abdomen brownish black, anterior ventral part of sides, and venter, yellowish to reddish brown.

Head dimensions from above slightly variable but on the average three-sevenths wider than long, on some specimens twice as wide as long, front feebly convex, temples moderately prominent, occiput slightly concave; face coarsely reticulate-punctate, circumocular and malar spaces minutely wrinkled; antennae slender compared with large size of body, but somewhat variable in relative length and diameter of its parts, scape (not including radicle) five times longer than its greatest diameter and as long as pedicel, F1, and F2 combined, pedicel longer than F1 (not including ring joint), F1 one-sixth longer than each of F2 to F5, these uniform in length, width, and form, each about two-fifths longer than thick, club compact, feebly thicker than funiculars, and almost as long as F4 and F5 combined, flagellum moderately hairy; pronota and mesonota umbilicately punctate and moderately hairy, mesopleura as usual aciculate, propodeal groove crossed in front by rounded carina extending caudo-laterad, anterior part of groove smooth, rest of the segment irregularly reticulate; submarginal vein bearing a row of 13 to 18, more often 15 to 17, setae; abdomen when normally extended rather

strongly compressed, mostly bare as usual, segments 1 and 2 polished, from 3 to apex very finely coriaceous, ovipositor sheath moderately hairy.

*Male*.—Length 3.3 to 4 mm., otherwise like the female, except antennae, which are as follows: Flagellum slenderer than in female, scape as long as pedicel, F1, and half of F2 combined, pedicel and F1 uniform in length, F1 barely longer than F2, F3 and F4 equal in length, slightly shorter than F2, and twice as long as thick, funiculars uniform in diameter, club compact, but sutures plain, feebly thicker than funicle, one-tenth shorter than F3 and F4 combined.

*Type locality*.—Los Angeles County, Calif.

*Type*.—Female, U.S.N.M. No. 20247.

Redescribed from the type, the allotype, and the specimens cited below. Original description from type and allotype, from type locality. The allotype, which is in the United States National Museum, was taken in April. The type specimens represent the darker color extreme of the species. In spite of this, and the lack of host data for the type, I feel reasonably certain that these are the same species as the specimens recorded below.

*Remarks*.—*D. isis* Girault lies between *D. dubia* Walsh and *D. varians* Walsh. It leans toward *variens* in the form and larger size of the submarginal band, but this is not often so extremely developed as in *variens*, and usually has the proximal margin more or less concave as in *dubia*. In its size it favors *dubia*, and in the head dimensions and the number of submarginal hairs it approaches this species more closely. But in its host relations it exhibits greater affinity for *variens* in that it has been reared from *Andricus*, and never from *Disholcaspis*, from which most of the specimens of *dubia* have been obtained.

In addition to the type specimens I have the following material reared from California galls: 4 females and 2 males from *Andricus suttoni* (Bassett), on California live oak (*Quercus agrifolia*) at Carmel; 6 females from the same gall and oak at Pasadena; 12, mostly males from *A. pomiformis* (Bassett) on *Q. agrifolia* at Pasadena; 2 females and 3 males from *A. spectabilis* Kinsey on *Q. chrysolepis* at San Jacinto; the above were reared by Doctor Kinsey, the cynipid gall makers issuing in February and March, 1920. I have one female from the same worker from *Plagiotrochus chrysolepidicola* (Ashmead) on *Q. dumosa*, at Paso Robles, the gall maker having been reared March 7, 1920. This specimen differs from the rest of the series in having the front half of the prothorax reddish, and the basal half of the abdomen below yellowish brown. Another female collected by A. F. Leach and sent me by Doctor Kinsey is from *A. californicus* (Bassett) on California white oak (*Q. lobata*) at Diablo, Calif.

The following were sent from the insect collection of Stanford University by Dr. Isabel McCracken who reared them: 4 females (L. S. J. Lot 554, Sub. 15) from "twig swelling" on *Q. agrifolia*, May, 1915, Stanford campus, and 3 females and 1 male (L. S. J. Lot 554, Sub. 118) from "twig swelling" on *Q. chrysolepis*, Stanford campus, June, 1916. In view of the rearings of Doctor Kinsey, it seems probable that the present "twig swelling" galls are those of members of the genus *Andricus*.

The United States National Museum collection contains three females and a male bearing record number 129°, which is probably equivalent to number 129<sup>k</sup>. The insects from the latter number came from a cynipid gall on *Q. agrifolia*, collected in August, 1885, at Alameda, Calif. The specimens bear the same locality name, one being labeled "Feb.," and another "Mar." There is also a female (Hopk. U. S. 15608<sup>b</sup>), reared May 24, 1918, by L. H. Weld, from an undetermined gall on *Q. agrifolia*, Los Gatos, Calif., and two females (Hopk. U. S. 15605c<sup>1</sup>), reared by L. H. Weld, June 8 and August 17, 1918, from galls on *Q. agrifolia*, at Montecito, Inyo County, Calif.

## 12. DECATOMA VARIANS Walsh

### PLATE 1, FIGURES 10, 11

*Decatoma varians* WALSH, Amer. Ent. and Bot., vol. 2, no. 10, p. 300, 1870.—ASHMEAD, Trans. Amer. Ent. Soc., vol. 14, p. 198, 1887; Colorado Biol. Assoc. Bull. 1, p. 45, 1890.—VIERECK, Trans. Amer. Ent. Soc., vol. 32, p. 246, 1906.—TRIGGEBSON, Ann. Ent. Soc. Amer., vol. 7, p. 8, 1914.

*Decatoma phellos* ASHMEAD, Can. Ent., vol. 13, no. 6, p. 136, June, 1881.

*Decatoma kelloggi* FULLAWAY, Journ. New York Ent. Soc., vol. 20, pp. 278, 279, 1912.

This species has been much confused with its close relatives, especially with *D. dubia*, which Walsh regarded as a variety of *varians*. The present species is somewhat smaller and, as a whole, much darker; its submarginal band is usually two-thirds or more as broad as long and reaches distinctly beyond the end of the stigmal vein. The best differences are in the proportions of the heads; in *varians* the head is about two-thirds as long as broad and subovate in dorsal outline, that of *dubia* is about half as long as its width and elongate-ovate in shape, transversely. *D. varians* almost always has the outer face of the hind femur mostly ochreous-yellow, and the hind tibiae mostly black.

*Female*.—Length 2.5 to 3.5 mm., fairly robust, colors pale ochreous-yellow, honey yellow, brown, rufous, and black, relative degrees of each extremely variable; head usually mostly light ochreous-yellow, a black spot on the vertex sometimes not extending beyond the ocelli,

sometimes covering the whole vertex, rarely extending over the superior half of the occiput; when black, vertex with at least a band along the eye and another oblique from the latter toward top of antennal scrobe, yellowish like most of head; front, cheeks, and back of head below at times lightly infuscate; scape dull yellow to lemon yellow, pedicel pale ochreous-yellow, sometimes brown to black above funicle and club unicolorous, pale, honey yellow, light brown or rufous, pronotum uniformly ochreous-yellow or with posterior margin black, or dorsal area with a subquadrate or otherwise shaped black patch sometimes covering as much as middle half or even with only the sides not black; ground color of mesonotum ochreous-yellow but more or less heavily infuscated, sometimes black, with lower part of scapulae, almost all the axillae, lower edges of scutellum, and sutures yellow or rufous, mesopleura usually not marked with black, metapleura sometimes entirely or not at all black; propodeum ochreous-yellow, or groove and anterior median surfaces black; coxae and trochanters usually plain yellow, hind coxae at times with one or two rather faint longitudinal black bands behind, otherwise unmarked, femora and tibiae colored like coxae but superior face of femora black, front femur least so, black area increasing on middle and hind femora, outer face of femur almost always mostly ochreous-yellow, front tibiae lightly infuscate or immaculate, middle tibiae moderately fuscous but still only on outer face, hind tibiae entirely brownish black, except base and apex, tarsi whitish yellow; stigma dark brown or black, the submarginal band "bottle-shaped," somewhat lighter brown than stigma, rarely reduced in size or deviating from the form here described, in extreme reduction about one-half as wide as long, reaching two-thirds across the wing, usually about two-thirds as broad as long, in one specimen only one-ninth longer than broad, proximal edge almost continuous with base of stigma and irregularly straight, apex fairly straight and forming a right angle with the proximal edge, distal margin broadly rounded and its farthest point usually extending beyond end of stigmal vein; secondary band very faint; abdomen mostly dark, basal third often honey yellow to rufous, shading caudad into reddish brown or brown and black, sheaths honey yellow to light brown.

Head from above almost two-thirds as long as broad, vertex, front, and eyes broadly rounded, or eyes not sharply set apart from their surroundings, temples prominent, rounded, or head, except the moderately concave occiput, almost ovate in transverse outline; face, including genae, reticulate, and with small circular depressions, malar space narrowly smooth and finely wrinkled, groove narrow and incomplete, broader at eyes, face sparsely and inconspicuously hairy; antennae rather densely hairy and broadening gradually and slightly from F1 to middle of club, as a whole relatively stout, scape (not

including radicle) as long as pedicel, F1, F2, and half of F3 combined, F1 four-fifths as long as pedicel and a fourth longer than F2 to F5, the latter segments each almost or quite as broad as long, sometimes distinctly but not greatly longer than thick; pronotum almost two-thirds as long as wide, slightly narrower than head and mesothorax, thorax above coarsely umbilicately punctate, mesopleura aciculate and minutely punctate; hairs on apex of wing about one-half as long as bristles on marginal vein, submarginal vein bearing a row of 12 to 16, more often 12, setae; abdomen bare, except a few hairs on third and fourth segments, last segment before ovipositor somewhat hairy, very smooth, polished, shiny, fourth and fifth segments very finely and densely granulose, the sculpture sometimes scarcely distinguishable, hairy parts punctate.

*Male*.—Differs from the female only in the usual different form of the abdomen, in having the submarginal band more frequently reduced distad, and in the proportions of the antennal joints; pedicel and F1 equal in length or F1 slightly longer, F1 two and a half times as long as maximum width and as broad as F2 to F4, the latter equal in length and width and each almost or quite two-thirds longer than thick, club scarcely longer than F3 and F4 combined and as broad as the funicular segments.

*Type locality*.—None given, but probably Rockford, Ill.

*Cotypes*.—Two females on one pin, and fragments of a third separately mounted, U. S. N. M. No. 1538.

These specimens were received by the National Museum in 1890 through A. Bolter, who was entomological curator in the museum of the Chicago Academy of Sciences, where the collection prepared by Doctor Walsh was deposited after his death.

*Remarks*.—The specimens from which Walsh described *varians* were reared by him from cynipid galls on oak. Kinsey interprets the original records as *Plagiotrochus punctatus* (Bassett), *Amphibolips inanis* (Osten Sacken), and *A. confluentus* form *spongifica* (Osten Sacken). A few specimens in the collection still bear notes in pencil showing that they were obtained from *P. punctatus*. I find none of Walsh's specimens with data to show that they were reared from *Amphibolips* spp. The National Museum collection also contains the following: 7 specimens of both sexes on one pin that are typical *varians* and bear Accession No. 5961a, A. D. Hopkins, West Virginia; a fine series of 19 females and 6 males from New Jersey, but without further data; 4 males bear record number 2972<sup>04</sup> with dates February 10, 1882, February 10 and 24 and March 1, 1883, and were reared from a cynipid gall on scrub oak at Martinez, Calif., by H. W. Turner (Doctor Kinsey interprets "scrub oak" there as usually *Quercus dumosa*); 3 females on one pin bear number 149<sup>o</sup>, which I take to be equivalent to 149k, and are from El Dorado, Calif.

(locality on pin) in cynipid galls on *Q. wislizenzii*, February, 1886; 1 from Mountain View, Calif., labeled "Ehrhorn Lot 2"; 3 males from galls questionably determined as *Dryophanta* on live oak (probably *Q. virginiana*), at Idlewild, Bexar County, Tex., L. Biediger, collector; 4 males reared by Doctor Ashmead from a gall on willow oak (*Q. phellos*), Jacksonville, Fla., April 18, 1881, and described by him as a distinct species, but it has all the essential characteristics of *D. varians* Walsh.

L. H. Weld sent me three from the galls of *Disholcaspis eldoraensis* (Beutenmueller) on *Q. lobata*, at Cottonwood, Calif., January 22, and four of each sex reared by him from the galls of *Biorhiza caepuliformis* (Beut.) at Evanston, Ill. The pins bear Weld's record number 270. The rather strange shade of yellow is probably due to the preservative in which these specimens were first kept, but the slightly more blocky form of head hints that these specimens comprise a distinct species. Specimens at hand include 2 (No. 245) of each sex from *Callirhytis gemmaria* (Ashmead), Evanston, Ill; 1 male (Hopk. U. S. 13685<sup>a</sup>) reared February 26, 1918, from galls of *Disholcaspis globulus* (Fitch) on *Q. alba*, Falls Church, Va., by William Middleton; 2 females and 1 male (Hopk. U. S. 14636<sup>b</sup>) reared by William Middleton, April 27, 1920, Falls Church, Va., from galls determined by him as *Callirhytis* sp. on *Q. alba*; 4 females (Hopk. U. S. 10774<sup>b</sup>) presumably from galls on *Q. stellata*, Ironton, Mo., May 28, 1919, and 1 female (Hopk. U. S. 10776<sup>a</sup>) from same locality, reared June 18, 1919, by S. A. Rohwer from galls determined by him as *Disholcaspis fasciata* Bassett, on common red oak (*Q. rubra*); 3 females and 1 male (Hopk. U. S. 10781<sup>a</sup>) reared by J. H. Pollock at Colorado Springs, Colo., presumably from galls, on an undetermined species of *Quercus*; 4 females and 3 males (Hopk. U. S. 13651<sup>m</sup>) reared by F. R. Herbert, February 26 and April 5, 1918, from galls determined by William Middleton as *Disholcaspis* sp., from *Q. durata* at Los Gatos, Calif.; L. H. Weld obtained 5 females and 1 male (Hopk. U. S. 15608<sup>b</sup>) from the same locality, May 24, 1918, presumably from galls, on *Q. agrifolia*, and 1 female (Hopk. U. S. 15605<sup>b</sup>) at Upland, Calif., June 8, 1918, from *Q. chrysolepis*. These Hopkins lots exhibit some further noteworthy variations. Specimens of both sexes from California and Missouri are as small as 2 or 2.1 mm. in length, and whereas the abdomen is usually more or less granulose in the species, some present individuals have this part perfectly smooth and polished. The setae on the submarginal veins range from 9 to 16, both extremes being found on California material. Several males from California are unusual in being black, only the oral area, the front lateral portions of the pronotum, and parts of the legs brown-yellow; on the other hand, the form of the head and wing band, the size and wing vestiture, and the



fact that they are part of a series of typical *varians*, show that they are probably this species. The specimens in the Missouri series are unique in having the band considerably reduced on the proximal and distal margins, but its maximum width is still greater than the length of the marginal vein. These Hopkins lots, however, agree in having the head rounded in front, face receding below antennal fossae, setae on submarginal vein usually 11 to 14, and in their general color pattern.

Dr. A. C. Kinsey provided five females from the galls of *Plagiotrochus chrysolepidicola* (Ashmead), var. undetermined, from *pugnus* Kinsey, in one instance on *Q. dumosa*, Paso Robles, Calif., and again from the same gall at Napa, Calif.; also from the same gall at Exeter, Calif., on *Q. lobata*, and others from Manitou, Colo., from *P. frequens frequens* (Gillette) on *Q. undulata*. The rearing dates for the cynipid gall makers of these Kinsey lots are in February, March, and April, 1920.

Several other California specimens were received through the courtesy of Dr. Isabel McCracken from Leland Stanford Junior University collection (Lot 554, Sub. 111) and reared by her from the galls of *Disholcaspis eldoradensis* (Beutenmueller) on *Q. lobata*, on the Stanford campus, April 1915.

I have not been able to examine specimens of *Decatoma kelloggi* Fullaway. Doctor McCracken kindly compared some of my Kinsey specimens with the type of *kelloggi* and reports that these differ in color from the type. *D. varians* Walsh, however, varies extremely in color. Fullaway states that the head of *kelloggi* is "fairly thick anterior-posteriorly," and the front wing has "a brown gourd-shaped cloud extending across the middle of the wing two-thirds its width." His specimens were reared by Mrs. Rose Patterson Blakeman from a "twig swelling" gall on *Quercus chrysolepis*, the galls collected at Stevens Creek, Santa Clara County, Calif. It is probable that this gall is a close relative, if not a member, of the genus *Plagiotrochus*, from which what I regard as *varians* Walsh has been reared. The head and wing characters quoted above are essential features of *varians*, and altogether it is very likely that *D. kelloggi* Fullaway is identical with Walsh's species.

The outstanding features of *varians* are: The greatly variable body color, the hind femora usually mostly ochreous-yellow outwardly, cheeks reticulate punctate, not polished and smooth, usually 13 to 15 setae on the submarginal vein, and the finely granulose sculpturing of at least the sides of the posterior half of the abdomen. It is also remarkable for its wide geographic distribution, and the broad range of genera of cynipid galls on oak from which it has been obtained.

There is so much variation in the color of this species from Illinois, the type locality, that specimens from the Western United States readily come within the extremes of the color differences. At first inclined to look upon the western lots, as well as some from Illinois, as representing several distinct species on account of both host and color differences, I am at last compelled by the lack of structural characters to regard them all as one. This same inconstancy of color and absence of morphological characters make it impossible to recognize varieties. These differences cut across the generic lines of the cynipid hosts and do not correlate with any geographic boundary lines.

### 13. DECATOMA DUBIA Walsh

#### PLATE 1, FIGURE 12

*Decatoma varians* var. *dubia* WALSH, Amer. Ent. and Bot., vol. 2, no. 10, p. 300, 1870.

Readily separated from *D. varians* Walsh with which it has been frequently confused, by its larger size, generally darker color, the narrower and longer curved submarginal band, and the distinctly relatively shorter and wider head which is much less produced in front than in *variens*.

*Female*.—Length 3.2 to 4.3 mm., usually of the larger size, fairly robust, mostly black above, some parts of body yellow to rufous and brown; head black, except narrow circumocular band, temples and cheeks mostly, malar space, antennal scrobe and an oblique bar from it to eye, and face at times only below antennae and at times to and including much of vertex, yellow or rufous-yellow, head almost entirely black in a few Michigan specimens; scape light ochreous-yellow, pedicel same but more or less fuscous above, ring joint yellow, flagellum chestnut-brown; sides of pronotum yellow like that of head, top in most cases black, but at times only median third, or even only posterior two-thirds of this area, black, rest yellow; mesothorax black, lower parts of scapulae and axillae and the pleura deep yellow, rufous, or brown to partly black; metathorax and propodeum black; legs mostly yellow, front coxae immaculate to black on anterior surface, middle and hind coxae sometimes rufous-yellow and sparsely marked black, femora yellow, disks of outer surfaces sparsely and feebly to broadly and deeply brown-black, tibiae light yellow, fore tibiae at times immaculate, at times faintly brown, or front pair faintly, and others increasingly brown, the hind pair deeply so except base and apex, tarsi faint yellowish white; stigma almost black, submarginal band deep dark brown, usually about two and a half times as long as wide, its width almost uniform throughout, rarely broader than length of stigma, crooked in form, bending distinctly toward body, reaching two-thirds across wing, its apex

rounded, but sometimes narrowed and roughly tapered; petiole black, abdomen mostly black, only about cephalo-ventral fourth brownish to mostly yellow.

Head mostly just one half as long as wide, sometimes slightly longer and narrower, transversely ovate-rectangular, front extending but feebly ahead of eyes, occiput only slightly concave, vertex laterad of posterior ocelli finely wrinkled and punctate, malar space smooth wrinkled, not punctured, rest of head coarsely reticulate with a small umbilicate puncture in each reticulation, and moderately hairy; scape of antenna as long as pedicel, F1 and half of F2 combined, pedicel and F1 about equal in length, F2 to F4 equally long and thick, length of each one-fifth greater than diameter, club compact and slightly dilated and as long as F4 and F5 combined; pronotum one-seventh narrower at its widest point than head and mesothorax, upper surfaces of prothorax and mesothorax densely and rather coarsely umbilicate punctate; propodeal groove deep, broad, rounded, crossed in front by a prominent carina; surface of propodeum coarsely rugose reticulate, more so in front of the carina; submarginal vein with 13 (rarely) to 19, frequently 18, setae; abdomen shiny, smooth polished, except sometimes third and fourth segments partly coriaceous, bare, except beyond third segment, latter with a transverse row of hairs in the middle, posterior surface of abdomen around ovipositor sheath moderately hairy and punctate, sheath extending prominently above tip of abdomen.

*Male*.—On the average smaller than the female, but in color, vestiture, sculpturing, and form like the female, except the usual difference in the shape of the abdomen and the antennae; F1 about one-sixth longer than pedicel, F2 barely or not at all longer than F3 and F4, F2 to F4 each one-fourth longer than thick, club feebly dilated and as long as F3 and F4 combined.

*Remarks*.—The original Walsh specimens of *dubia* are perhaps destroyed. One female in the United States National Museum collection is labeled "*Decatoma dubia* Walsh," probably in Walsh's handwriting, but there is no date, locality, or host given to show whether or not it was used in preparing the original description. Only five females and one male were originally at hand when the form was described. They were reared by Doctor Walsh from the galls of *Disholcaspis mamma* (Walsh) on the mossycup oak (*Quercus macrocarpa*).

This species is well represented from areas ranging from Arizona and Texas through the Mississippi Valley to the Atlantic Ocean from the northern to the southern limits of the United States. But considering the distribution of its variety *doanei* Fullaway, *dubia* occurs also in California areas of the country. Whenever host records accompany the specimens they indicate that *dubia* inhabits

mostly the galls (only stem gall known as hosts to date) of various species of *Disholcaspis* on different oak species of the *Leucobalanus* group. A few records from *Belonocnema* are at hand. Specimens that I have identified as this species are present as follows: 6 females and 3 males from stem galls of *Disholcaspis mamma* (Walsh) on *Q. macrocarpa*, Urbana, Ill., April 20 to June, 1923, and May 20 to June 18, 1924, and from Catlin, Ill., 1 female from the stem gall of *D. globulus* (Fitch) on swamp chestnut oak (*Q. michauxii*), reared April 15, 1929; also 4 females and 4 males from Urbana, Ill., but from stem gall of *D. globulus* (Fitch) on *Q. alba*, May and June, 1923; the aforementioned material was reared by myself; 1 of each sex probably reared by Doctor Walsh at Rockford, Ill., and 1 female labeled "through A. Bolter, 1890." L. H. Weld sent me 4 of each sex bearing No. 38 and reared by him from *D. mamma* (Walsh) at Evanston, Ill., and 4 females from the same host and with the same number reared at Manistee, Mich., June 15, 1907; 7 females and 2 males (U.S.N.M. coll.) were originally obtained from the Michigan Agricultural College, some reared June 28 and 29, 1887, from "red-oak lesser globular leaf-gall," Acc. Cat. 738, and others with Acc. Cat. Nos. 857 (March 23, 1888) and 900 (May 28, 1887) came from the galls of *D. mamma* (Walsh) and *D. globulus* (Fitch), respectively, and one with Acc. Cat. No. 720A (June 23, 1887) is from "bastard-oak apple gall," and another bearing data "Mich., 903" without host records is this species; 2 females (189<sup>xo1</sup>) that issued in April, 1895, 1 labeled "on *Holcaspis globulus*" were reared by J. G. Barlow at Cadet, Mo., both probably coming from the stem gall of *D. globulus* (Fitch); from the same place and collector, are 3 specimens (389<sup>xo2</sup>) dated July 26, 1883, with no host records available; 1 female (2610<sup>o4</sup>), probably this species, was reared on May 4, 1882, from a cynipid oak gall received from H. K. Morrison, Fort Grant, Ariz., on March 23 of the same year; 1 female from "Fitch's Collection," and 2 of this sex on one point labeled "Westcott" are without question *dubia*; 4 females and 1 male (165<sup>xo2</sup>), reared June 28, 1883, from the gall of *Belonocnema fossoria* Weld [*Disholcaspis virens* (Ashmead)] on *Q. virens* received from H. G. Hubbard, Crescent City, Fla.; 2 males on one pin (165) reared on March 13, 1875, from galls of *B. fossoria* Weld collected by Muhleman from *Q. virens* (?) on October 31, 1874; 3 males from the same species of gall but on *Q. stellata* (*obtusiloba*), the galls collected by Patton at Selma, Ala., in October, 1880, and the insects issuing on December 16 of that year; 1 male (165<sup>xo</sup>) is from Heavue, Tex., another without locality or hosts (165<sup>xo</sup>) with label "on oak, Mar. 13, 1875," and a third was from an "undetermined oak gall"; 2 females and 1 male from Texas (Belfrage coll.); 10 females and 3 males reared by C. N. Ainslie from the galls of *D. mamma*

(Walsh) on mossy cup oak (*Q. macrocarpa*); I have 3 additional females from Mr. Ainslie taken by him by sweeping alfalfa at Salt Lake, Utah, and bearing Webster No. 5595, but they are smaller than typical *dubia*; 3 males (66<sup>xo1</sup>) issued from galls of *D. globulus* (Fitch), June 27, 1883, the galls received from A. T. Packard, Providence, R. I., on April 7 of the same year; 2 females (66<sup>xo1</sup>) dated March 4, 1884, bear no other data; 1 female labeled "Melrose Highlands, Mass., July 7," and the following Hopkins lots: 5 females and a male (Hopk. U. S. 13686<sup>e</sup>), reared April 5, 12, and 29, 1918, by L. H. Weld, from galls of *Disholcaspis spongiosa* Karsch on *Q. minor* at one or more of these localities: Thebes, Liberty County, Ga., and Palestine, Trinity, or Houston, Tex.; 1 female (Hopk. U. S. 10774a) reared May 14, 1919, by S. A. Rohwer, from undetermined galls on *Q. minor*, at Iron-ton, Mo.; a pair (Hopk. U. S. 10776a), same collector and locality, reared June 11 (male) and 18 (female), 1919, from galls of *D. fasciata* Bassett (determined S. A. Rohwer) on *Q. rubra*; 1 female (Hopk. U. S. 10777a) reared by S. A. Rohwer, Poplar Bluff, Mo., June 4, 1919, from gall on *Q. minor*; and 2 pairs (Hopk. U. S. 10777b), from undetermined galls on *Q. minor*, Poplar Bluff, Mo., the males issuing June 18 and July 2, and the females on May 14 and June 26, 1919; 5 females and 4 males labeled Worcester, Mass., and Providence and Rumford, R. I., sent me by Doctor Kinsey from the Thompson collection, had been reared from the galls of *D. mamma* (Walsh) and *D. globulus* (Fitch); I have a fine series of 20 females and 2 males reared by Doctor Kinsey from galls of *D. mamma* var. on *Q. bicolor* at Broadway, N. J., on September 4, 1921. From the collection of the Canadian Department of Agriculture, Ottawa, I have 2 females from bullet galls on mossycup oak [*D. mamma* (Walsh) on *Q. macrocarpa*] collected by G. E. Sanders at Tampico, Ill., on May 15 and 20, and July 26, 1909; also one female labeled "on office window, Mar. 3, 1906, J. F."; and one of each sex reared from the gall of *D. globulus* (Fitch) at Guelph, Ontario, by T. D. J.

#### 14. DECATOMA DUBIA RUFOSA, new variety

##### PLATE 1, FIGURE 13

Differs chiefly from the typical form of *D. dubia* Walsh in having the head and thorax almost or entirely reddish yellow.

*Female*.—3 to 4.1 mm. long, colors chiefly rufous and black; head rufous, sometimes vertex and also occiput above more or less dark brown, antennae chestnut-brown; prothorax golden brown to light reddish yellow; mesothorax concolorous with head but sometimes front of prescutum, lower edge of axillae posterior margin of scutellum, and margins of dorsal sclerites narrowly black; metanotum and propodeum rufous to almost black; legs entirely very pale yellowish

brown, hind tibiae at times dusky brown as in *dubia*; submarginal band in color, size, and form as in *dubia*; abdomen dark brown to black, except that antero-ventral part is in small part light brown to brownish yellow.

The dimensions of the head, the measurements of the antennal joints, the sculpturing and the vestiture of the parts, including the number of setae on the submarginal vein, agree with the typical *dubia*.

*Male*.—Differs from the female only in being slightly smaller on the average, and in the dimensions of the antennal joints, the latter agreeing with those of *dubia*.

*Type locality*.—Charleston, S. C.

*Type*.—Female, U.S.N.M. No. 42235.

Described from the type, the allotype, and five female paratypes; type, allotype, and three paratypes in collection of the United States National Museum, and two paratypes in the writer's collection.

*Remarks*.—All the type material was reared from the galls of *Belonocnema fossoria* Weld [*Disholcaspis virens* (Ashmead)] at Charleston, S. C., by J. T. Rogers and Charles Pon. One specimen of the series bears a label "Rohwer 2015" and "Pon 287."

In addition I find the following of this variety: 6 females (No. 165<sup>ox2</sup>) from the galls of *Belonocnema fossoria* Weld [*Disholcaspis virens* (Ashmead)] on *Quercus stellata* (*obtusiloba*), collected by Patton at Selma, Ala., in October, 1880, and the chalcids issued December 16 of that year; another series (165<sup>xo2</sup>) of 4 females, June 28, 1883, are from the same cynipid and oak hosts, from Crescent City, Fla. (H. G. Hubbard); 3 females (165<sup>xo2</sup>) are probably from the same hosts and region; 1 females (165<sup>xo</sup>) is labeled Heavue, Tex.; another from post oak (*Q. stellata*), June 10; 1 of same sex labeled "Mo., 715<sup>xo</sup>, June 6, 1883"; a male with data "J. L. Zabris-kie, Nyack, N. Y., Feb. 6, 1884"; 3 females and a male from eastern Florida, Ashmead; 3 females and a male, some with undecipherable records in pencil, others with no data; one from Doctor Kinsey, reared from the gall of *Disholcaspis mamma* var. on *Q. bicolor* at Broadway, N. J.; a single female reared by myself from the stem gall of *D. mamma* (Walsh) on *Q. macrocarpa* at Urbana, Ill., on June 18, 1924; 1 female from gall of *D. globulus* (Fitch) on *Q. alba*, April 24, 1918, Falls Church, Va., reared by William Middleton; L. H. Weld reared 1 female of this variety (Hopk. U. S. 13686<sup>e</sup>) from the gall of *Disholcaspis spongiosa* Karsch on *Q. minor* at one of the following localities: Thebes, Liberty County, Ga., and Palestine, Trinity, and Houston, Tex. The rearing date is May 15, 1918, whereas six typical females of *D. dubia* Walsh issued from the same galls on April 12, 1918.

It is possible that this is a distinct species, but it has been reared from the same lots of galls from which some of the *dubia* material came, and there is some evidence that *dubia* proper and its variety *rufosa* intergrade in color. A larger series, especially additional material from the States intermediate between Illinois and Alabama, is needed to determine the extent of the color variation. There are no recognizable differences in size, sculpturing, vestiture, or dimensions of the head or dimensions of the antennal segments.

15. *DECATOMA DUBIA* var. *DOANEI* Fullaway

PLATE 2, FIGURE 14

*Decatoma doanei* FULLAWAY, Journ. New York Ent. Soc., vol. 20, pp. 279, 280, 1912.

Most like the typical *D. dubia* Walsh in color, size, dimensions of the head and the antennal segments, and form of the submarginal band; it is darker and smaller on the average, and usually has fewer setae on the submarginal vein.

*Female*.—Length 3.2 to 4 mm., colors yellow and black, mostly black; head black, circumocular space and an oblique band from it to antennae, malar area, and face below antennal fossae and at times above them halfway to vertex, yellowish to reddish brown; scape dark yellow, in part lightly infusate, pedicel yellow like scape, but mostly brownish black above, flagellum dark chestnut-brown; prothorax always mostly black above, its sides and anterior face more or less yellowish brown, sometimes a black spot in the lateral depression, on some specimens a faint line of this color from near middle in front obliquely to front end of parapsidal grooves; mesothorax, metathorax, and propodeum black, except mesopleura, tegulae, and narrow area at lower edges of scapulae and axillae, which are reddish brown; coxae black except sometimes the apex, or a stripe on posterior lateral face, outer disks of fore and middle femora, all of hind femora except ends, and front tibiae usually brownish yellow, middle tibiae lightly to moderately brown on outer face, and hind tibiae brown except at base and apex, tarsi light to whitish yellow; stigma dark brown, submarginal band medium brown, slightly more than twice as long as wide, width not quite uniform, but not much broader or more narrow than length of stigma, apex curving strongly toward base of wing, distal edge reaching almost or quite as far as stigmal vein, apex rounded; abdomen black, only antero-ventral portion more or less yellowish brown.

Head moderately hairy, very nearly twice as broad as long, face almost flat or slightly convex, vertex weakly convex, occiput slightly concave, malar space smooth in groove only, rest finely coriaceous or sculptured like face, vertex in part around anterior ocellus only



finely punctate, occiput, face, and cheeks with rather coarser punctures than thorax, or subreticulate; antennae rather stout, scape as long as pedicel, F1, and half of F2, moderately dilated toward base, pedicel and F1 about equal in length, latter one-fifth longer than each of F2 to F5, latter each about one-fifth longer than its maximum thickness, length of club equal to that of F3 to F5 combined; width of head and mesothorax nearly equal, pronotum about six-sevenths as wide as mesothorax, dorsal punctures of thorax coarsely umbilicate, bearing small white hairs; 13 to 16 setae on submarginal vein; abdomen mostly smooth and bare, segments beyond the second with a few hairs, more around ovipositor sheath, latter also coriaceous, third and fourth more or less with fine wrinkles, especially on lower lateral surface.

*Male*.—Like the female in color, vestiture, and sculpturing, but in general slightly smaller and slenderer, from 3.2 to 3.6 mm. long. The ratio of head dimensions is the same in both sexes. Antennae slenderer than in the female, scape gradually dilated toward base, F1 slightly longer than pedicel and one-sixth longer than F2, F3, or F4, latter about equally long or F2 slightly longer than F3 or F4, and each nearly two-thirds as thick as long, club not much thicker than funicle, scarcely dilated, and as long as F3 and F4 combined.

*Type locality*.—Jaspar Ridge, Stanford University campus, Calif.

*Type*.—Described from one female from the gall of *Disholcaspis eldoradensis* (Beutenmueller) on *Quercus dumosa*, Stanford University collection reared by Mrs. Rose Patterson Blakeman.

*Remarks*.—The description of the male is based on one specimen kindly sent me by Dr. Isabel McCracken, curator of the insect collection at Stanford University, California. That collection contains a few other specimens. These lots of material bear record numbers L. S. Jr. U. Lot 508, Subs. 19, 45, and 508, and were reared by Doctor McCracken and Mrs. Blakeman.

Doctor Kinsey sent me the following reared from California galls: 2 females from *D. canescens* (Bassett) on blue oak (*Q. douglasi*) at Merced Falls, and another from the same hosts at El Portal; 1 female from *D. eldoradensis* var. on California white oak (*Q. lobata*) at Diablo; 1 female from *D. plumbella* Kinsey at Upland, and another from the same gall on *Q. dumosa* at Descanso; and 2 females and a male from *D. corallina* (Bassett) on *Q. douglasi* at Napa; the cynipid hosts of the Diablo lot were reared in November, 1923, and those of the remaining series issued in February and March of 1920. The collection of the United States National Museum contains 3 females from the galls of *D. eldoradensis* (Beutenmueller) on *Q. lobata* taken at Cottonwood, Calif., on January 22, presumably 1925; 3 males from the same locality and oak, and probably the same gall, on January 1, 1925; a series of 4 of each sex from Placer County, Calif. (55°, which



is probably of the same series of record numbers as 55k for which the accompanying data are at hand), from cynipid gall on *Q. chrysolepis*, the galls collected October 8, 1885, and the chalcids issuing December 19, 1885; 1 female (3798<sup>x1</sup>) from *D. chrysolepidis* Beutenmueller on *Q. chrysolepis* collected at Colfax, Placer County, by Albert Koebele, the galls having been received at Washington, D. C., on October 17, 1885, and the insects issued December 28 of that year; 1 female labeled Mountain View, Calif., Ehrhorn lot 2; 2 females (55<sup>a</sup>) are from Sonoma County, Calif.; 1 male (59<sup>o</sup>) was collected in Placer County, Calif., in February, 1886; and 1 female (3837<sup>x</sup>) was reared in January 19, 1886, from a cynipid gall on *Q. douglasi*, Marin County, Calif. A typical female of variety *doanei* is in the collection of the Illinois State Natural History Survey, collected in Colorado and bearing number 1256.

Three females sent me by C. N. Ainslie and collected by him by sweeping alfalfa at Salt Lake, Utah, and bearing Webster No. 5595, seem to be this species. It is probable that they were taken in the vicinity of cynipid-infested oaks.

The general similarity of variety *doanei* Fullaway to *dubia* Walsh in size, color pattern, sculpture, and vestiture, and their common occurrence in the galls of different species of the genus *Disholcaspis*, compel me to conclude that *doanei* is not a distinct species but only a geographic variety. Even as such, it is separable from the typical form *dubia* only by inconstant characters of average size, and the number of setae on the submarginal vein. The series of California material at hand is so small that no conclusions concerning the limits of these characters can be formed at present. The variety *rufosa* Balduf, known in greatest numbers to date from the Southern States, is much more distinct from the typical *dubia* than is the variety *doanei* Fullaway.

#### 16. DECATOMA LOBATAE, new species

#### PLATE 2, FIGURE 15

Closest to *brevilobae*, new species from Texas, in being the same size, in having the same number of setae on the submarginal vein, and in the similar form of the submarginal band. *D. lobatae*, however, is in general lighter in color and differs especially in the longer and more narrow head and the more strongly convex front. The funicular joints are also shorter, being as broad as long, or slightly broader than long.

*Female*.—Length 2.3 to 2.6 mm., colors yellow, yellowish brown, reddish brown, and brownish black or black; head mostly light brownish yellow, only the neck below, ocellar area, and occiput around the foramen black; upper part of face black, and the black of vertex and occiput faintly confluent on one specimen, but well

separated and demarcated on the rest; scape a shade lighter yellow than face, pedicel mostly same, but brown above in part, except the apex, flagellum medium brown; pronotum golden yellow tinged with brown, mesal fifth more or less dark on account of black showing through from anterior overlapped portion of mesonotum; prescutum usually mostly dark brown, parapsidal grooves and more or less of their border areas narrowly reddish brown, broadly yellowish brown on one specimen, scutellum with at least a broad mesal black or dark brown band broadening behind, more often this sclerite dark, except margins narrowly, scapulae and axillae also mostly light yellowish brown, or suffused with light to medium brown, mesopleura entirely yellowish brown, anterior ventral face of mesothorax darker; propodeum black except lighter apex, legs yellowish and dark brown, coxae yellow, hind pair with black stripe on outer and inner faces, trochanters yellow, femora mostly so, but superior faces of front and middle members and also inner and apical portions of outer face of hind femur brown black, fore tibiae brown black outwardly, middle and hind tibiae entirely of this color except bases and apices narrowly; submarginal band dark brown, almost twice as long as greatest width, reaching two-thirds across wing, its margins ragged, the apical margin constricted necklike just beyond stigma and moderately rounded, the proximal margin slightly concave, apex less intense, fading; no secondary band present; petiole black, abdomen brown black to brown above, sides from brown to brownish yellow, venter light brown-yellow.

Head one-sixth wider than pronotum, and two-thirds or slightly more than three-fifths as long as broad, margins of eyes not prominently set off from surrounding parts, face rather strongly convex as seen from above, occiput feebly convex, vertex broadly rounded longitudinally and transversely, genae and malar space polished and moderately strigose longitudinally, face reticulate punctate, vertex mostly with faint reticulations, these and intervals finely punctate, occiput and temples likewise, face moderately hairy, other parts bare; antennae fairly stout, pedicel about a fourth longer than F1, latter barely longer than F2, F3 to F5 equal in length and each as broad as long or slightly broader and a bit shorter than F2, funicle feebly thicker at apex than at base, antennal vestiture moderate in length and density, inconspicuous as usual; pronotum and mesonotum coarsely umbilicately punctate, mesopleura aciculate or ribbed, ribs of anterior half branching freely and rather densely and finely punctate; carina crossing propodeal groove in front bending posteriorly quite sharply forming a broad V, the angle small but rounded, groove also crossed by about six straight and almost parallel rugae at rather regular intervals, rest of pro-

podal surface more or less uniformly reticulate behind the branches of the anterior carina; submarginal band with about 12 setae in a row; abdominal segments one to three smooth, but not highly polished, at least sides of fourth finely roughened, granulose, moderately hairy, and punctate at the ovipositor sheath.

*Male*.—Unknown.

*Type locality*.—Paso Robles, Calif.

*Type*.—Female, U.S.N.M. No. 42237.

Doctor Kinsey sent me all the type material. It consists of two females, one of which I have designated the type, reared from the galls of *Neuroterus quercicola pacificus*, form *varians* Kinsey, on *Quercus lobata*, at Paso Robles, Calif., and six other more or less fragmentary females reared from the galls of *Andricus wiltzae* Fullaway on the same oak in the same locality as the first two specimens. The gall makers of these lots issued March 7, 1920. Three paratypes are in the United States National Museum with the type. The other paratypes are in my own collection.

#### 17. DECATOMA GLOBULI, new species

##### PLATE 2, FIGURE 16

Similar to *D. novascotiae*, new species, in size and in having a narrow, curved submarginal band. The body of *globuli* is less robust, particularly the head is less blocky, and the color in general is more black than in this species.

*Female*.—Length 2.1 to 3 mm., color more black than yellowish brown; head mostly black, usually with more or less yellow-brown in circumoral area, this color sometimes extending to antennal fossae and including malar space, and branching along lateral margins of antennal scrobe to frons and also around eyes, forming a narrow circumocular band, a rather faint oblique band arising from latter on vertex reaching toward upper limit of scrobe, and dilating more or less on temples, or including genae entirely, the scrobe black; scape yellow with variable longitudinal black bands laterad, pedicel mostly brown, apex above and apical half below yellow, ring joint yellow, flagellar joint yellowish brown, infusate above; pronotum usually mostly black, at least a yellow triangle on anterior lateral half, sometimes the whole side of the pronotum yellow, and on some specimens the anterior lateral area of the dorsum, and at times also the neck in part, yellow; prescutum, scutellum, most of scapulae and axillae above, metapleura, and propodeum, black; scapulae and axillae otherwise, and mesopleura, rufous-yellow, latter sometimes partly lightly infusate; coxae black except apices, or mixed yellow and brown, trochanters yellowish, femora same but superior faces of front and middle femora, and inner and outer faces of hind

femur, brownish black, or all legs with femora mostly black in the extreme instance, tibiae mostly brown-black on the same specimen but usually front tibiae immaculate yellow, middle tibiae yellow on inner face only, hind tibiae entirely dark brown, except bases and apices; submarginal band dark brown (newly emerged specimens), curved, narrow, twice as wide as long, about as broad as length of stigma, or rarely slightly broader, reaching two-thirds of way to hind edge of wing, proximal and apical margins parallel or subparallel, or distinctly concave and convex, respectively, no secondary band; abdomen with ventro-anterior fourth light brown, sometimes entire region black.

Head fairly robust, four-sevenths as long as wide, front seen from above less than moderately rounded transversely, occiput feebly concave, vertex mostly only finely punctate between ocelli and laterad to eyes, also sparsely marked with shallow umbilicate pits, narrow circumocular and malar spaces smooth or minutely wrinkled, genae, and frons to oral region rather coarsely reticulate, pitted, and moderately hairy; antennae fairly stout, scape as long as pedicel, F1, and half of F2 combined, pedicel slightly longer than F1, this one-fourth longer than each of F2 to F5, these equal in length and usually as broad as long, sometimes about one-seventh longer than thick, club compact, as long as F5, F4, and a fourth of F3 combined; head about one-seventh wider than pronotum, latter almost as broad as mesothorax, pronotum and mesonotum umbilicately punctate, moderately hairy, hairs silvery, sides of pronotum longitudinally striate, mesopleura aciculate and minutely punctured, the anterior half more conspicuously so and convex, the posterior half less so and concave; 12 to 15 but more often 12 or 13, setae on submarginal vein; propodeal groove limited in front by a prominent carina in the form of a broad V with rather sharply rounded apex, anterior third of groove deeper, the rest broader and more shallow, and with five rugae crossing somewhat parallel at irregular intervals, rest of propodeal surface variously and rather coarsely reticulate; first three abdominal segments smooth and shiny, fourth revealing front edge coriaceous when fully extended, lower portions of sides likewise coriaceous, rest of surface slightly less shiny than preceding segments, posterior surface adjoining ovipositor sheath punctate and moderately hairy.

*Male*.—Length 2.1 to 2.8 mm., dimensions, vestiture, sculpturing, and color as described above; antennae less stout than in female, F1 barely longer than pedicel and a fifth longer than F2, F3, and F4, latter three almost equal in length and each five-eighths as thick as long, club as long as F4, F3, and a fifth of F2 combined.

*Type locality*.—Catlin, Ill.

*Type*.—Female, U. S. N. M. No. 42240.

The type is selected from a series of nine females and four males reared by the writer in the laboratory during the period of March 15 to April 15, 1929, from the galls of *Disholcaspis globulus* var. undetermined, collected from the stems of, and from the ground beneath, one specimen of *Quercus michauxii* at Catlin, Ill., on February 24, 1929. The galls and oak were determined by Doctor Kinsey. The paratypes are in the collections of the United States National Museum and the writer, and the allotype is deposited with the type.

*Remarks.*—The United States National Museum collection contains two specimens bearing record number 66<sup>101</sup>, which issued on June 28, 1883, from the galls of *D. globulus* (Fitch). The galls were collected by A. T. Packard at Providence, R. I., and were received at Washington, D. C., on April 7, 1863. I have one male from Doctor Kinsey reared by A. F. Leach, Diablo, Calif., in 1923, from the galls of *D. eldoradensis* var. on *Quercus lobata*; and from the same oak, at Cottonwood, Calif., two females and a male from undetermined galls; also a female and two males that I reared from the galls of *D. globulus* (Fitch) on *Q. alba* between May 1 and 15, 1923, at Urbana, Ill. Three females and a male were obtained from the galls of *Biorhiza forticornis* (Walsh) by L. H. Weld (No. 36) at Evanston, Ill. Two males (Hopk. U. S. 13685<sup>e</sup>) were reared by William Middleton at Falls Church, Va., April 5 and 12, 1918, from the galls of *D. globulus* on *Q. alba*. The same lot of galls contained *D. varians* Walsh, *D. dubia* Walsh, and *D. dubia* var. *rufosa* Balduf.

The following are additional Hopkins lots: A female and 3 males (Hopk. U. S. 15637<sup>a</sup>), reared October 2, 1922, by L. H. Weld, Tijeras, N. Mex., from galls of *Disholcaspis* sp. undescribed, on *Q. pungens*; 2 females (Hopk. U. S. 15637<sup>b</sup>), same locality and oak, by Weld, from gall of *Andricus tecturnarum* Kinsey; a male (Hopk. U. S. 15637<sup>c</sup>), reared June 1, 1922, Las Vegas, N. Mex., from galls of *Callirhytis ruginosus* (Bassett) collected on various oaks; a female and 3 males (Hopk. U. S. 13686<sup>e</sup>), reared by L. H. Weld, April 5, 1918, from galls of *Disholcaspis spongiosa* Karsch, on *Q. stellata* at one or more of the following localities: Thebes, Liberty County, Ga., or Palestine, Trinity, or Houston, Tex.; 1 female (Hopk. U. S. 10777<sup>a</sup>), reared by S. A. Rohwer, May 14, 1919, Poplar Bluff, Ariz., from galls on *Q. stellata*; and a pair (Hopk. U. S. 10777<sup>b</sup>), same collector, locality, and oak, May 14 and 21, 1919, with no cynipid record. There is also a lot of 2 females and 9 males (Hopk. U. S. 1365<sup>m</sup>), reared by F. R. Herbert, February 26, and April 5 and 24, 1918, at Los Gatos, Calif., from galls of *Disholcaspis* sp. on *Q. chrysolepis*.

I sometimes have difficulty in distinguishing between this species and *dubia* Walsh. *D. globuli* Balduf may represent the smaller,

darker extreme of *dubia*. The latter varies somewhat in length, and even in the relative width and length of the head, the more robust heads merging with the typical *globuli* head in dimensions. In most instances, however, the head proportions, body length, and number of setae on the submarginal vein readily distinguish them and seem to justify their separation as two species. On the other hand, small specimens of *globuli* grade into the larger *D. nigriceps* Walsh in form of the head, size of body, and coloration. The subglobose head and small size of the more extreme *nigriceps* require that they be treated as distinct from *globuli*. Here there seems to occur a series of species merging into one another, without well-defined specific limiting characters by which the border line individuals may be distinguished. All of them have at least certain species of *Disholcaspis* as common hosts.

18. *DECATOMA NOVASCOTIAE*, new species

PLATE 2, FIGURE 17

Similar to *dubia* Walsh in being mostly black, and in having a narrow, curved wing band, but is easily distinguished by its smaller size, the lower numerical range of setae on the submarginal vein, and in the distinctly narrower and longer, more blocky head. The head of this species differs from that of most others of similar dimensions in being almost equally long throughout its width.

*Female*.—Length 2.6 to 3 mm., mostly black with some yellow, brownish yellow, and brown; head color quite variable, from mostly black to mostly rich yellow, in one extreme only area around mouth-parts and circumocular band, latter expanding caudad on temples, yellow; in other extreme black on vertex continuing broadly over occiput to neck, this briefly interrupted on occiput, and circumocular band of yellow always present with varying width on vertex; face may be black to antennal fossae, and ocular band of yellow on temples very variable in width, reaching occiput in a slender neck-like band, or broadly, or expanding slightly and not reaching occiput; antennal scrobe yellow, scape mostly yellow, outwardly brown, pedicel light brown, yellow at apex, flagellum almost uniformly reddish brown or light brown; pronotum black above, occasionally an oblique longitudinal fine stripe of yellow in middle of each half, sides yellow full length but more broadly in front and extending mesad along upper anterior edge, but not reaching middle; mesonotum black, only scapulae sometimes feebly in front and behind, and axillae on side in front, somewhat yellow, mesopleura yellowish brown except upper portion of caudal half, which is black, meta-thorax and propodeum black; coxae lemon yellow to dull yellow, except front coxa, which is faintly fuscous outwardly, and outer

half and basal parts of front and inner surfaces, which are black, trochanters yellow, fore femora mostly fuscous outwardly, mid femora including upper and lower faces same, hind femora also fuscous with only outer face mostly yellowish, tibiae mostly brown, front pair only outwardly, middle pair entirely except inwardly, and hind pair completely, only bases and apices narrowly not so, tarsi stramineous-yellow, apex a bit darker; submarginal band brown, about twice as long as broad, reaching two-thirds across wing, broadest at middle, barely narrower here than length of stigma, tapering and fading irregularly toward its apex, proximal margin broadly rounded but not quite regular, distal margin expanding broadly at middle but not extending quite so far as end of stigmal vein, secondary band very faint; petiole black, abdomen black or dark brown, except anterior-ventral aspect, which is in small part yellowish brown.

Body fairly robust; head three-fifths as long as broad almost its entire width, face not prominently convex, temples convex, occiput moderately concave from above; vertex and occiput moderately to sparsely umbilicate punctate, punctures small and shallow, intervals between umbilicate punctures finely and densely punctate, genae more coarsely and sparingly pitted, posterior orbits and malar spaces in part finely wrinkled, latter largely smooth, polished; face reticulate punctate; head rather sparsely hairy, antennae more densely so, scape slightly longer than pedicel and F1 combined, pedicel about a fifth longer than F1, latter one-fourth longer than F2, each of following funicular joints barely shorter and thicker than the preceding, F2 a fourth longer than broad, and F5 almost as broad as long, club compact and tapering to blunt tip, and as long as F5, F4, and half of F3 combined; head one-sixth broader than pronotum and slightly broader than mesothorax; nota of thorax quite coarsely umbilicately punctate, sides of pronotum longitudinally strigose, mesopleura moderately concave, aciculate and finely punctate on anterior sclerite, posterior half feebly convex, finely and more densely aciculate, the fine punctures not readily visible; propodeal groove crossed by a V-shaped carina, its apex broadly rounded, groove mostly polished but feebly rugose on more than posterior half, remainder of the segment rather coarsely reticulate; submarginal vein with 13 to 15, more often the latter, setae, hairs on apical margin of front wing slightly longer than normal; first three abdominal segments highly polished, fourth semiopaque, very finely granulose, posterior face of abdomen moderately punctate and hairy, hairs coarse.

*Male*.—Length 2.6 to 3 mm., colors, vestiture, and dimensions as described for female; scape of antennae slightly stouter than in the



female, its length equal to length of pedicel, F1, and base of F2 combined, pedicel and F1 equal in length, latter one-sixth longer than F2, F2 to F4 uniform in length and diameter, each one-fourth longer than its maximum diameter, club compact, three times as long as its greatest thickness, as long as F4, F3, and a fourth of F2 combined.

*Type locality*.—Lequille, Nova Scotia, Canada.

*Type*.—Female, Canadian National Museum No. 3102.

*Paratypes*.—Female and male, U.S.N.M. No. 42238.

The type, the allotype, and 1 female and 2 male paratypes were reared by Prof. G. E. Saunders from the galls of *Neuroterus batatus* (Fitch) on April 2, 1911, from the type locality; 1 female and 3 male paratypes from the same host by H. S. Payne, Bear River, April 3, 1911; and 1 of each sex issued April 12, 1911, at Round Hill, G. E. Saunders collector, without host data, but probably belonging to the same lot as the above. The type and allotype are in the Canadian collection, and the paratypes are divided among the collections of that institution, the United States National Museum, and the writer.

*Remarks*.—Later I find in the National Museum 17 females and 11 males that are probably this species. The range in length and color is greater in this lot than in the smaller type series. The average color pattern agrees quite closely with that of the types, and the size varies from 2.6 to 4.3 mm., or an average of 3.5 mm. The number of setae on the submarginal vein is from 13 on the smaller and more yellow individuals to 17 on the larger and darker specimens. The best evidence, however, that they are *novascotiae* is the form of the head. A series of measurements shows it to be three-fifths as long as broad, and about equally long over its entire width, quite blocky in form, which is a rather distinct feature in this species. The submarginal band is broad on the basal half and tapers usually to a sharp tip, and at the same time bends toward the base of the wing as in some other species. The present series (Quaintance No. 1730) was reared by R. A. Cushman between May 12 and June 1, 1911, at Vienna, Va., from the galls of *Callirhytis cornigera* (Osten Sacken). Kinsey<sup>8</sup> states that these occur on black oaks in the Eastern United States.

#### 19. DECATOMA FLAVIPES, new species

Resembles *D. flamminneiventris* Girault in size, dimensions, and form of the head, numerical range of hairs on the submarginal vein, unsculptured abdomen, in having the sides of the body yellow, and

<sup>8</sup> Indiana Univ. Studies No. 53, vol. 9, p. 105, 1922.



the dorsal surfaces moderately black; *flavipes* has legs entirely yellow, the submarginal band always at least twice as long as wide and with an angular emargination on the proximal margin and a heel-like prominence on the distal edge, and the surface vestiture of the wings is normally not reduced and inconspicuous as in *flamminneiventris*.

*Female*.—Length 3.4 to 4 mm., rather robust, colors black, yellow, and yellowish brown; head mostly dull golden yellow, vertex and back of head to neck and temples black except narrow ocular ring and at times a sharp lateral yellow emargination on vertex; scape whitish yellow, pedicel brown-black above, its apex and the flagellum chestnut-brown, sometimes lightly infusate above, palpi very light yellow; pronotum yellow, slightly darker than head, a circular median area of black reaching hind margin, about four-fifths to front margin, and sometimes joining black of neck by a band of varying widths, not infrequently a black patch on each side of the dorsal surface; mesonotum mostly black, the parapsidal grooves, scapulae except in posterior middle, scuto-axillar grooves, and sides of scutellum and axillae, brownish yellow, mesopleura, metapleura, and sides and posterior-lateral face of propodeum yellow like face and cheeks, propodeum otherwise and sternum of thorax in part, black; stigma dark brown, submarginal band medium brown, its width almost uniform, and always distinctly less than length of stigma, length only slightly variable and easily more than twice as long as wide, basal two-fifths extending sharply disto-caudad, band then bending somewhat abruptly caudo-proximad, and feebly narrowed at bend, outer margin produced heel-like just beyond stigmal vein, and roundly emarginate on proximal margin; legs yellow, slightly lighter than sides of pronotum, hind femora and tibiae sometimes lightly infusate, tarsi stramineous-yellow; abdomen shiny light yellowish brown, peduncle mostly black, dorsum of first abdominal segment with a narrow median longitudinal black band, broadening on hind portion, continuing over segments 2 and 3, broadening greatly on disk of each.

Head uniformly very nearly twice as wide as long, length 0.52 of width, outline of head from above transversely subrectangulate-ovate, face broadly rounded and protruding only slightly beyond eyes, eyes and front definitely demarcated at their junctures, back of head feebly concave, vertex moderately convex, malar space partly and cheeks mostly aciculate, vertex finely and densely punctate with interspersed small umbilicate punctures, latter numerous on back of head, face more sparsely punctate and moderately hairy; pedicel almost one-third as long as scape, subconical, slightly longer than F1, latter one-fifth longer than F2, F2 to F5 almost uniformly

long and thick, each one-fourth longer than broad, these dimensions slightly various on different specimens, club only a little longer than F4 and F5 combined; nota of prothorax and mesothorax umbilicately punctured, but more densely and not so coarsely as in many species of the genus, both the front and hind halves of lateral surfaces of mesopleura aciculate, posterior half more plainly so but with fewer minute punctures; propodeum variously and coarsely rugose-reticulate, groove deep with its basin rounded and limited in front by a V-shaped carina, its apex obtuse and feebly rounded, groove crossed by several low rugae; submarginal vein with a row of 15 to 19 setae, rarely 19, usually 15 to 17; abdomen smooth, polished, unsculptured laterad, rarely feebly granulose on parts of posterior half, hairy and punctate around sheath of ovipositor.

*Male*.—Length 3.5 mm., somewhat less robust and darker than female; color of head and antennae as in female; lateral areas of pronotum each with an elongate black patch, metapleura, sides of propodeum mostly, and hind coxae with middle of outer faces and peduncle entirely, black; wing band reduced in length, only two-fifths as long as in female, dorsal half of abdomen solidly brown black; dimensions of head, its sculpture as well as that of mesopleura and propodeum, and vestiture of wings, as described for female; F1 twice as long as broad, and a sixth longer and slightly broader than pedicel, and a sixth longer than each of F2 to F4, each of latter three-fifths as broad as long, their length uniform, club as long as F3 and F4 combined.

*Type locality*.—Oracle, Ariz.

*Type*.—Female, U.S.N.M. No. 42239.

The type, the allotype, and 14 female paratypes are in the collection of the United States National Museum, and I have 5 female paratypes in my own collection. This species is described and known from this series of 20 females and 1 male (Hopk. U. S. 15639<sup>a</sup>) reared by L. H. Weld on September 28, 1922, at Oracle, Ariz., from the galls of *Plagiotrochus* (*Andricus*) *coxii* (Bassett) (determined Weld), on *Quercus emoryi*.

*Remarks*.—Its size, form of the head, color of the body and legs, and shape of the submarginal band combine to make this one of the most distinct species in the genus. It is probable that some variation from the color of the lot at hand will be found in series discovered in the future. Though it approaches *flamminneiventris* Girault most nearly in color and size, it is far removed from that species in habit. It approximates *dubia* Walsh in size, in the form of the head, and the dimensions of the wing band, and agrees with it in vestiture of the submarginal vein, but the color differentiates it sharply from that species.

20. *DECATOMA FLAMMINNEIVENTRIS* Girault

PLATE 2, FIGURE 18; PLATE 3, FIGURES 27-29; PLATE 4, FIGURES 37, 41

*Decatoma flamminneiventris* GIRAULT, Proc. U. S. Nat. Mus., vol. 58, p. 208, 1920.

This is one of the outstanding species of the genus, differing from all other mostly yellow species in having in most specimens a subquadrate submarginal band, the wings clothed with very minute spines on the surfaces and margins, and in the absence of the pattern of large hairs usually found on the basal third of the front wings; definitely larger than any other mostly yellow species, except *disholcaspidis* Balduf.

*Female*.—Length 3.7 mm., fairly robust, colors chiefly black and yellow; head and antennae honey yellow, mandibles brown, ocellar region and occiput narrowly, black, apex of scape and base of pedicel light brown, eyes brown; prothorax colored like the head, with a broad dorsal longitudinal band of black widening behind and merging reddish brown into the surrounding yellow; rest of thorax and propodeum more brownish yellow, dorsal band of pronotum continuing to end of propodeal groove, spreading laterad on front portion of propodeum, scutellar black area oval covering all but lower sides, and prescutal band only half as broad with edges almost straight, scapulae and axillae without black, sterna of thorax black between coxae; legs honey yellow, tibiae and tarsi slightly darker, except hind tibiae yellow-brown; submarginal band of wing deep brown at base, fading toward apex, subquadrate (one-half longer than broad on the specimens from New Mexico and as broad as long on the Colorado specimens), proximal edge concave, apical margin convex and reaching beyond apex of stigma but not to end of stigmal vein, extending less than a third across the wing, secondary band wanting; abdomen light brown, ochreous.

Head slightly more than a half longer than wide, face moderately convex, vertex but feebly so, malar groove definite, reaching to base of mandibles, cheeks entirely smooth, polished and bare, rest of head uniformly rather coarsely umbilicate punctate, but ocellar area also finely punctured and moderately hairy, antennae slightly more hairy; scape (not including bulb) a little longer than pedicel plus F1, pedicel slightly longer than F1, latter a third longer than F2, F2 to F4 subequal in length, one-fifth longer than thick, and almost equal in diameter; prothorax only slightly narrower than head and mesothorax, nota moderately hairy and umbilicately punctate, mesopleura rather coarsely aciculate and finely punctate, a row of 15 to 17 setae on submarginal vein, surface of apical two-thirds finely and irregularly undate and rather sparingly vested with minute tapering hairs that are easily overlooked, margin also bearing such hairs.

cubital and subdiscoidal ridges present, but hairs inconspicuous, basal third of wing lacking pattern of long hairs usually present in this group; abdomen mostly bare, sparsely to moderately hairy from middle to apex, surface unsculptured and shiny.

*Male*.—Length 4 mm., form more slender than female, colored like female, except ocellar area and nota of thorax are more largely black, pronotal band narrower than that of prescutum, both scapulae and axillae tipped above with black, and middle of outer faces of hind coxae black; pedicel and abdomen above darkened.

Vestiture and sculpture including malar space and cheeks not different from female, scape as long as pedicel, F1 and half of F2 combined, F1 one-third longer than each of F2 to F4 and not much shorter than pedicel, F2 to F4 about equal in length and each one-fifth longer than wide, mesopleura coarsely aciculate and punctate as in female; submarginal vein with about 17 setae, surface vestiture of wing perhaps slightly coarser than in female.

*Type locality*.—Fort Collins, Colo.

*Type*.—Female, U.S.N.M. No. 20867.

Redescribed from all the material cited herewith.

*Remarks*.—The type and one female and two male paratypes were obtained by C. F. Baker as parasites of the yucca moth, *Prodoxus quinquepunctellus* Chambers (*decipiens* Riley) on September 19, 1893. A few additional specimens of both sexes from the same place, date, and host, and labeled "Colo., 1231," and a female reared by Chas. F. Hicks in Boulder County, Colo., April 30, 1926, from the above species of yucca moth, are in the National Museum collection. The species is also represented by material bearing No. 3059°, 19/5/84 and 12/5/84, reared on these dates from *Prodoxus y-inversus* Riley on pod of yucca from New Mexico brought to the Bureau of Entomology of the United States Department of Agriculture on May 11, 1883, by Prof. D. C. Chapman, of Washington, D. C. Two females labeled "Colo., 1777" belong to the Illinois State Natural History Survey collection, Urbana, Ill.

## 21. DECATOMA BREVILOBAE, new species

### PLATE 2, FIGURE 21

Similar to *varians* Walsh in the number of setae on the submarginal vein, and in colors, but readily distinguished by its much narrower and curved wing band, the shorter and broader form of the head, and the smaller size of the body.

*Female*.—Length 2.3 to 2.8 mm., mostly 2.4 mm., mostly black and yellow to reddish brown; head yellowish to reddish brown, sometimes two spots on forehead, vertex from antennal scrobe, and occiput black; antennae light brown, scape and pedicel dull yellow, latter

feebly brown above; pronotum light yellowish brown, with a subquadrangular black area on median third, sometimes neck feebly black at the middle; prescutum, scutel, and propodeum black except sides, which are narrowly or feebly reddish brown; mesopleura yellowish or reddish brown, scapulae and axillae same, with only their upper surfaces narrowly black; legs mostly yellowish, the outer surfaces of femora and tibiae of the middle legs lightly infuscated, those of hind legs darker; submarginal band dark brown, on the average twice as long as wide, measuring from inner edge of stigma, proximal margin rather sharply emarginate before the middle, distal margin produced, proximal and distal margins subparallel, apical portion of band curving distinctly toward base of wing, apex subtruncate; no secondary band; abdomen deep brown black, except venter narrowly and lower anterior fourth of sides, which are yellowish brown fading into the dark brown above.

Head slightly variable in form, from twice as wide as long in most specimens to almost three-fifths as long as broad, front feebly to moderately convex from above, occiput slightly concave; head feebly reticulate, narrow space along upper part of malar groove smooth, the rest of the groove, the genae, and the vertex sculptured like face, except a small space laterad of each posterior ocellus, which is finely punctate, the usual small umbilicate punctures wanting; antennae moderately stout, scape slightly more than four times as long as thick (not including radicle), and as long as pedicel, F1, and half of F2 combined, pedicel and F1 equal in length, F2 to F5 uniform in length and each four-fifths as thick as long, diameter of club and funicle alike, club compact and as long as F5, F4, and half of F3 combined; pronotum five-sixths the width of the head and the mesonotum, mesopleura aciculate and finely punctate; anterior of propodeal groove crossed by V-shaped carina, the apex of the angle rounded, groove also crossed at irregular intervals by a series of parallel rugae, sides of propodeum coarsely reticulate; submarginal vein with a row of 11 to 14 setae; all of abdomen smooth, polished; few hairs on segment 4, region of ovipositor sheath moderately hairy.

*Male*.—Length 2.2 mm., blacker than female; entire occiput, hind margins of genae, face almost down to antennal fossae, vertex entirely black; antennae slightly darker than on female; all of pronotum above, except lateral edges, mesothorax, metathorax, and propodeum, black, mesopleura reddish brown to partly black, front femora infuscate outwardly, femora and tibiae of middle and hind legs brown except bases and apices, hind coxae with faint longitudinal black stripes; submarginal band dark, almost twice as long as wide; head two-thirds as long as broad, face rounded, vertex mostly only finely punctate; antennae more slender than in female, pedicel and

F1 equal in length, F2 to F4 one-half longer than thick, club compact and almost as long as F4, F3, and F2 together; submarginal vein with 11 setae; abdomen entirely polished above, venter in part coriaceous.

*Type locality*.—Austin, Tex.

*Type*.—Female, U.S.N.M. No. 42242.

*Remarks*.—The type and one male and seven female paratypes were reared by Dr. J. T. Patterson from the galls of *Andricus murtfeldtae* Ashmead on *Quercus breviloba* at the type locality. The material was sent me by Doctor Kinsey. L. H. Weld reared a female from the gall of *Callirhytis flavipes* (Gillette) on *Q. macrocarpa* at Moline, Ill.

The single male at hand exhibits an unusual degree of color variance from that of the female. The sculpture of the vertex and the dimensions of the head also depart strikingly from the condition in the other sex. It may be that further rearings will show these differences of the male to be abnormal.

22. *DECATOMA OCCIDENTALIS*, new species

PLATE 2, FIGURES 19, 20

Similar to *nigriceps* Walsh in color, but distinctly larger, head usually shorter and wider, submarginal band usually longer and less variable in length, often almost twice as long as wide; abdominal segments more extensively coriaceous than in *nigriceps*.

*Female*.—Length, 2.5 to 3.5 mm., almost entirely black; head black, mandibles brown, sometimes a faint ocular band either in front of or behind eye, or both, and rarely a fine line on lateral edges of antennal scrobe, brownish yellow; scape yellow, pedicel brown, but yellow at apex and somewhat more extensively so beneath, ring joint yellow, flagellum uniformly chestnut-brown; pronotum black, except a yellowish brown patch on anterior lateral corners, which extends more or less mesad on anterior surface and caudad on lateral surface but not beyond middle; rest of thorax and propodeum wholly black; rest of legs brownish black, except trochanters, which are partly yellowish brown, apical half of front femora, most of front tibiae, especially their bases and apices broadly, and these parts of the other femora and tibiae, yellowish brown, tarsi stramineous-yellow; stigma dark brown, submarginal band medium brown, length varying from one-half longer than wide to twice as long as wide, but somewhat shorter than wide to one-half longer than wide on the specimens from Arizona and New Mexico, and entirely lacking on one male and one female from Arizona, width of band not greater than length of stigma, scarcely touching stigmal vein, distal margin convex, and obtusely angulate just beyond stigmal vein, proximal

margin broadly rounded, concave, apex more or less pointed and fading out; abdomen black to reddish brown, lighter below.

Head dimensions slightly variable, from four-sevenths as long as wide to only one-half as long as wide, mostly the latter, never distinctly longer at middle than at sides of face, head noticeably wider than prothorax, about as broad as mesothorax, most of its surfaces moderately hairy and reticulate-punctate, malar space and genae the same, malar groove hairless and finely rugose; antennae moderately hairy, rather robust, scape as long as pedicel, F1, and F2 combined, pedicel slightly longer than F1, F1 almost a fourth longer than F2, latter about as long as each of F3 to F5, these broadening slightly toward club and scarcely longer than broad, club slightly longer than F4 and F5 combined; dorsum of thorax umbilicately punctate, mesopleura aciculate and finely punctate; propodeal sculpturing reticulate, groove polished in front, rugose behind like rest of propodeum; submarginal vein bearing a row of 13 to 17 setae; abdomen mostly polished, segments 3 and 4 always finely coriaceous on the sides, sometimes the dorsum also, region of ovipositor sheath hairy and punctate.

*Male*.—Length, 2.3 to 2.6 mm., colors, vestiture, and dimensions as described for the female; antennae less stout, the scape as long as pedicel, F1, and half of F2 combined, pedicel and F1 about equal in length, F1 a fifth longer than F2 and three-fifths as thick as long, F2, F3, and F4 subequal in length, each one-fourth longer than thick, club compact and as long as F4, F3, and half of F2 combined.

*Type locality*.—San Bernardino, Calif.

*Type*.—Female, U.S.N.M. No. 42236.

*Remarks*.—The type, the allotype, and 18 female and male paratypes were reared by Dr. A. C. Kinsey from the leaf galls of *Andricus lasius areolaris* Kinsey taken at the type locality on *Quercus chrysolepis*. The gall maker came from the galls on January 31, 1920. The allotype and a paratype of each sex are with the type in the United States National Museum. The rest of the paratypes are in the writer's collection.

It was reared as follows by Doctor Kinsey in California from cynipid galls: *Andricus lasius sublasius* Kinsey on *Q. chrysolepis*, Pasadena and San Jacinto; *A. lasius lasius* Ashmead on *Q. chrysolepis*, El Portal; same gall and oak at Dunsmuir and Placerville; *Plagiotrochus chrysolepidicola* (Ashmead) on *Q. dumosa*, at Paso Robles; *Disholcaspis corallina* (Bassett) on *Q. douglasi* at Napa; *D. canescens* (Bassett) on *Q. douglasi*, at Galt; and *Cynips weldi* var. on *Q. grisea*, Prescott, Ariz. A good series of both sexes is involved in these records. The Cynipidae were reared from these lots between January 25 and April 3, 1920.



Other specimens found in the National Museum were reared from galls as follows: 4 females and 2 males from *Disholcaspis truckeensis* (Ashmead), Big Bar, Calif., L. H. Weld collector, bearing Weld's record number 1622; 3 labeled "Ex *Diplolepis echina* O. S., California, Weld #1707"; and 7 females and 10 males with record No. 2615°, reared from April 4 to 20, 1882, from petiole galls on live oak (interpreted by Dr. William Trelease, University of Illinois, as *Q. virginiana*). These galls were collected by H. K. Morrison on March 24 and April 2, 1882; Mr. Weld also reared the following, except as otherwise stated: 11 females and 6 males (Hopk. U. S. 15637°) September 28 and 29, 1922, from galls on *Q. pungens* at Tijeras, N. Mex.; 1 female (Hopk. U. S. 15637<sup>1</sup>) on July 1, 1922, from galls of *Callirhytis ruginosus* (Bassett) on *Quercus* sp., Las Vegas, N. Mex.; 1 female (Hopk. U. S. 15639<sup>a</sup>), September 28, 1922, from galls on *Q. emoryi*, at Oracle, Ariz.; 5 females and a male (Hopk. U. S. 15922<sup>h</sup>) May 21 and 28, 1918, from galls of *Andricus* (determined Middleton) on *Q. chrysolepis* at Los Gatos, Calif.; 1 female (Hopk. U. S. 15607°), June 17, 1918, at Paso Robles, Calif., from galls resembling *Neuroterus majalis* (Bassett), on *Q. douglasi*; 5 females (Hopk. U. S. 13687°) July 12, 1918, at Esparara Cañon, Ariz., from galls of *Adleria* (determined Weld) on *Q. oblongifolia*; 6 females and 10 males (Hopk. U. S. 15639°) January 23, February 3, and September 28, 1922, mostly labeled Oracle, Ariz., from galls on *Q. arizonica*; 6 females (Hopk. U. S. 15604°) at Prescott, Ariz., May 15 and June 1 and 17, 1918, from galls of *Callirhytis ruginosus* (Bassett), on *Q. grisea* or *arizonica*; 8 of each sex (Hopk. U. S. 10781<sup>s</sup>) reared by George Hofer, May 21 to July 16, 1919, Sycamore Flat, Ariz., from galls on *Q. oblongifolia*; and 5 females and 6 males (Hopk. U. S. 10773<sup>w</sup>) reared May 28 and June 11, 1919, by J. H. Pollock, Colorado Springs, Colo., from galls on *Q. gambelii*. One female labeled "Colo. 1257" is in the collection of the Illinois State Natural History Survey.

Nowhere in the genus *Decatoma* has been observed so striking a correlation between color development and geographical distribution as in *D. occidentalis*. There is good reason for including *D. florida* Girault as a member in the series that shows this correlation. These species are extremely similar in being almost entirely black, with only the anterior lateral upper corners of the pronotum, and sometimes a narrow ocular ring, yellow brown. Structurally they are alike in the number of setae on the submarginal vein, and the form of the head, which is almost or actually twice as wide as long, the face feebly or not at all convex, and the surfaces, except the malar space narrowly along the groove, are sculptured in a uniform manner in both species. The differences between them are in the color of the



legs and the extent of development of the submarginal band of the front wing. *D. florida* falls in the old genus *Eudecatoma* of Ashmead, there being but the usual faint trace of a submarginal band on the inner edge of the stigma. It is consistently rudimentary in the whole series of 10 females at hand. Correlated with the absence of the band is the yellow of all parts of the legs except the coxae, which are black.

Neither of the two species is known to date from areas between Florida and New Mexico or from States just west and north of the latter. A series of both sexes from Oracle, Ariz., has in it a pair that must, by all the characters known, be classified as *D. florida*. No color band is present, and the legs are yellow beyond the coxae. All the other specimens of this series from that locality, however, and a number of individuals from Prescott, Ariz., have all the legs more or less black, as in the typical *D. occidentalis* from California, and the color band is in almost every instance not fully formed, usually being only one-half as long as on the California members of the species where it is somewhat more than twice as long as broad and broadly curved. Another good series, from Sycamore Flat, Ariz., has mostly black legs like those of the Oracle lot, but the band of the wing is fully formed in the majority of specimens. Material from Colorado Springs, Colo., compares favorably with the latter. Three lots, from Tijeras, N. Mex.; Esparara Cañon, Ariz.; and Los Gatos, Calif., respectively, have complete bands almost without exception. The band is not abbreviated in any of the specimens from Pasadena, El Portal, Dunsmuir, Placerville, Paso Robles, Napa, and Galt, Calif. There is a little evidence that *florida* inhabits galls of *Andricus flocci* (Walsh) in Florida, and Kinsey reared the Prescott, Ariz., lot from galls of *Cynips*, and the typical California *occidentalis* from *Andricus*, *Plagiotrochus*, and *Disholcaspis*. Weld reared the lot from Esparara Cañon, Ariz., from the galls of *Adleria*.

This instance particularly throws doubt on the value of *Eudecatoma* Ashmead as a distinct genus, in view of the extreme variation in length of the submarginal band.

### 23. DECATOMA OCCIDENTALIS FLAVIFRONS, new variety

Differs from the typical *D. occidentalis* Balduf only in color, having the face and cheeks mostly yellow, the pronotum and legs more yellow, and sides of mesothorax in part so. The dimensions of the funicular joints and the head, the sculpturing of the head, mesopleura and abdomen, and the number of setae on the submarginal vein agree with the typical black form of this species. The wing band is shortened as in typical specimens from the Southwestern States.

*Male*.—Length 3 mm., colors black and yellow; back of head, vertex, cheeks in part behind, malar space entirely on one specimen, and forehead in part, black; one specimen with pronotum yellow brown only on front lateral corner, as on typical black *occidentalis*, but entire side and the anterior lateral portion of upper surface of pronotum yellow on the other specimen; mesopleura black on one specimen but lower third of scapulae, and upper portion of mesopleura yellow on the other; legs of lighter-colored specimen with bases of front and middle coxae, and all of hind coxae, black, femora and tibiae of all legs with at least middle of outer surfaces narrowly black, legs otherwise yellow, except tarsi, which are stramineous, the other specimen with legs dark as on typical specimens of *occidentalis*; venter of abdomen yellow.

*Type locality*.—Prescott, Ariz.

*Type*.—Male, U.S.N.M. No. 42268.

*Remarks*.—Described from the type and a male paratype, both in the National Museum and from the type locality. They were reared by L. H. Weld, May 15 and August 17, 1918, from undetermined galls on an evergreen oak (*Quercus grisea* or *arizonica*). The type issued on the latter date. Both individuals are labeled "Hopk. U. S. 15604<sup>a</sup>."

#### 24. *DECATOMA NIGRICEPS* Walsh

##### PLATE 2, FIGURE 22

*Decatoma nigriceps* WALSH, Amer. Ent. and Bot., vol. 2, no. 10, pp. 300, 301, 1870.

Perhaps nearest to *occidentalis* Balduf, from which it may be distinguished by the differences enumerated before the description of that species.

*Female*.—Length 1.8 to 2.2 mm., mostly black with greatly variable degrees of yellow; head black, except a narrow circumocular yellowish-brown band with sometimes an oblique wedge-shaped branch extending forward from it on the vertex toward the antennal scrobe, lateral margins of scrobe usually, oral area more or less, in some specimens a band extending upward from oral region to each antennal fossa and in others to the malar space narrowly, yellowish brown, and a few specimens have the head yellow except the vertex and the forehead; palpi whitish; scape entirely honey yellow, pedicel yellowish beneath, light brown above, flagellum medium to dark brown; pronotum black but anterior lateral corners always, and sometimes the side more or less, dull yellow, in some specimens all the anterior margin of the segment dull yellow, in others only the mesal third of the upper surface black, with front margin yellow; mesothorax black, lower part or all of scapulae and

axillae, and more or less and sometimes all of mesopleura, brownish yellow, darker than the yellow of the pronotum; metanotum and propodeum black, except at times the latter is faintly yellow; apices of coxae yellow, the rest black, trochanters yellow, femora and tibiae mostly brownish black, their bases and apices yellow, tarsi stramineous-yellow, in some specimens the coxae and most of the rest of legs yellow; submarginal band pale to medium brown, extremely variable in size, extending from one-third to two-thirds across the wing, width rather constant regardless of length, maximum width scarcely greater than length of stigma, band curved in form, first bending toward apex, then at end turning toward base of wing, tapering slightly at tip, no secondary band present; pedicel black, abdomen brownish to black, some specimens yellow shading to brown on anterior-ventral part, one specimen with entire abdomen yellow except dorsum, ovipositor sheath sometimes more or less yellowish.

Head three-fifths to two-thirds as long as broad, rounded above, front strongly to moderately rounded and protruding, occiput rather strongly convex; vertex only sparsely marked with small umbilicate punctures and in part punctate, malar space and genae rather coarsely wrinkled, shiny, rest of head, especially the face, coarsely reticulate, punctures few, sparsely hairy, more densely hairy above oral space; antennae moderately hairy, relatively robust, scape moderately thickened near base, as long as pedicel, F1, and part of F2 combined, pedicel one-fifth longer than F1, F2 to F5 of equal length and width, each scarcely longer than broad, club slightly thicker than funicle and tapering from second segment to blunt tip; head and mesothorax slightly broader than prothorax, pronotum more than twice as broad as long, parapsidal grooves complete but narrow and shallow, thorax coarsely umbilicately punctate and moderately hairy; anal margin of wing beyond hamular fold rather strongly dilated, surface densely hairy, submarginal vein with a row of 10 to 13 setae, more often 11; abdomen rather strongly compressed, highly polished, smooth, except dorsum of fifth segment sometimes feebly coriaceous, and the sides of the sixth sparsely pitted near the spiracle, segments 5 and 6 sparsely and moderately hairy, respectively, tips of ovipositor sheaths protruding rather prominently beyond apex of abdomen, region of sheaths hairy, punctate.

*Male*.—Length, 1.8 to 2 mm.; slenderer and generally somewhat darker than the female, vestiture and sculpture as in that sex; legs almost lemon yellow in a few specimens; scape slightly longer than pedicel and F1 combined, pedicel and F1 almost equal in length, F2 to F4 each two-fifths longer than its greatest thickness, their length uniform and each about five-sixths the length of F1, club

slightly smaller in diameter than funicle, length equal to F1 plus F2, with a fairly blunt end.

*Type locality*.—Probably Rock Island, Ill.

*Cotypes*.—A female and two males, U.S.N.M. No. 1535.

*Remarks*.—Redescribed chiefly from the two male cotypes and a series of both sexes reared from the same source as the original specimens. The description was checked with the female cotype. Color extremes as found from Virginia are also included in the description. This species has been difficult to identify with certainty by means of the description by Walsh, which does not agree in some color features with the type material and other specimens reared later by others. Notably, the scape is always yellow instead of brown black, as described by Walsh. It is recognizable, however, from the original account by the size, its usually mostly black color, the extremely variable extent of the submarginal band, and the host. The male paratypes have the legs chiefly yellow, whereas the other specimens check with the original description in having the legs chiefly black. It has been thought that many of Walsh's specimens were destroyed in the Chicago fire. Doctor Walsh originally possessed 3 males and 2 females reared September 22 to 24, and 40 males and 16 females reared May 8 to 20 from the oak-fig gall, *Biorhiza* (*Xanthoteras*) *forticornis* (Walsh) (*ficus* Fitch). The only other series in my possession that is positively known to have been reared from this gall was received from Doctor Kinsey, who reared them at Forest Hill, Boston, Mass. The host insects issued between April 8 and July 9, 1918. This series consists of 21 males and 8 females. *B. forticornis* is known to make its galls on white oak (*Quercus alba*), dwarf chinquapin oak (*Q. prinoides*), and chestnut oak (*Q. prinus*), and may occur on other species of *Leucobalanus*. Additional specimens are at hand as follows: 16 females and 13 males bearing the record numbers 2F41<sup>01</sup>, 2F41<sup>02</sup>, and 2F41<sup>03</sup>, with dates ranging from August 6, 1882, to August 5, 1884. The records show that these were the rearing dates of specimens collected several weeks earlier in galls from *Q. alba* in Virginia. Some of the data were lost in the meantime, and the cynipid host of this lot is not known; 1 male is labeled New Brunswick, N. J.; 10 females and 4 males with no data are mounted on a single card; 2 females and 5 males originated at the Michigan Agricultural College with the accession catalogue numbers and data as follows: 857, March 24, 1888, from the gall of *Disholcaspis* (*Holcaspis*) *mamma* (Walsh); 600B, March 23, 1887, from mossycup oak (*Q. macrocarpa*), "corky gall," *D. mamma*; 601, April 25, 1887, reared from white-oak bladder gall, without scientific name; 601A, April 28, 1887, reared from same as 601; and 738, June 27, 1887, from "red-oak lesser globular leaf gall." The rearings were probably by

Gager C. Davis. Three females and two males in the entomological collection of the Canadian Department of Agriculture, Ottawa, were collected at Tampico, Ill., on June 15, 1909, by G. E. Saunders. One of the pins bears a corky gall, probably of *Disholcaspis mamma* (Walsh). I have 2 females and 10 males from *D. mamma* on *Q. macrocarpa* at Urbana, Ill., reared in indoor cages from April 20 to June, 1923. L. H. Weld presented three females and one male reared by him at Evanston, Ill., from the gall of *Plagiotrochus* (*Callirhytis*) *tumifica* (Osten Sacken) on red oak (*Q. maxima*). A lone male in the collection of the United States National Museum bears data as follows: April, Riley County, Kans., Marlatt, 983; a female (Hopk. U. S. 10777<sup>b</sup>) reared May 14, 1919, and a male (Hopk. U. S. 10777<sup>a</sup>) dated May 7, 1919, are both presumably from galls, on *Q. minor*, at Poplar Bluff, Mo., by S. A. Rohwer.

It is not possible to distinguish positively between some *nigriceps* Walsh and certain individuals of *globuli* Balduf. The smaller individuals of the latter grade into the larger specimens of the former, and this merging is also true of the form of the heads, the shape and extent of the band on the wing, and the coloration. I do not place as *globuli* any specimens with an imperfect wing band. This band is very often more or less reduced in *nigriceps*. The head of the *nigriceps* as described originally by Walsh is subglobose, and about two-thirds as long as broad, whereas it is always about three-fifths as long as broad in *globuli* and approaches a transversely rectangulate-ovate form as seen from above. But the lots from the Michigan Agricultural College contain specimens that range from abbreviated bands and somewhat rounded heads in the one extreme to complete bands and rectangulate-ovate heads on the other extreme from the same host. They can therefore be classed as either species, and such a classification is valueless. It is possible that these supposed species are all one, but this theory leads to trouble when it is recognized that the larger *globuli* grade into the smaller, more stocky-headed forms of *dubia* Walsh, which certainly is a distinct species by virtue of its size and usually the dimensions of the head. I prefer to believe that three species are involved here, which, however, are not sharply definable in terms of structural characters studied to date. Any arbitrary limitations of size, form, and color are not positively practicable for convenience of separation, and certainly are misleading as means of indicating the true natural border lines of these species, but are now our only known aids for making even approximate distinction. A study of the genitalia may prove helpful in the search for means of separating the border-line specimens.

25. *DECATOMA NIGRICEPS* var. *EXCRUCIANS* Walsh

Walsh<sup>9</sup> recognized this variety, the specimens of which, he states, "differ from the normal form of *nigriceps* only in the scape of the antennae being dull rufous instead of brown-black. The antennal groove is black." He had three males and one female reared July 2 from the gall of the cynipid, *Andricus seminator* Harris [*Callirhytis seminator* (Harris)]. None of this material is at hand. The extreme variation of color in this species, even in lots obtained at one time from the same locality and hosts, is so great that any color limit set up for varieties has no value. I am compelled to disregard this variety of Walsh.

26. *DECATOMA SUBIMMACULATA* Girault

*Decatoma subimmaculata* GIRAULT, Journ. Ent. and Zool., vol. 9, p. 11, 1917.

*Decatoma autumnalis* GIRAULT, Proc. U. S. Nat. Mus., vol. 58, p. 209, 1920.

*Decatoma compressa* GIRAULT, Proc. U. S. Nat. Mus., vol. 58, pp. 209-210, 1920.

Nearest to *D. querci-lanae* (Fitch) in its mostly yellow body, but is distinguishable by its lack of most of the black dorsal markings on the thorax present on Fitch's species. *D. subimmaculata* is, in general, somewhat larger.

*Female*.—Length 2.5 to 4.9 mm., mostly 3 mm. or longer, moderately robust, colors chiefly golden or honey yellow, in small part black; head yellow but space within ocelli, and forward into antennal scrobe more or less, and occiput about halfway from foramen to eyes behind, black; scape concolorous with head or lined with brown on basal part of outer edge, pedicel feebly infusate above mostly on basal two-thirds, flagellum light brown; pronotum usually immaculate golden yellow, sometimes darkened behind by black on prescutum beneath or occasionally on hind part of pronotum itself; mesothorax concolorous with pronotum, prescutum at times immaculate, but more often a subtriangular patch of black on disk, which extends forward broadly under pronotum and tapers caudad, front edge of scutellum at times faintly black, and a mere tinge of black longitudinally on the middle and sometimes small areas black on lower edge of axillae near tegulae; metanotum yellow, propodeum black on middle half in front, and groove sometimes narrowly, sometimes broadly black, sternum of thorax not extensively black; legs immaculate, light yellow, tibiae approaching stramineous-yellow, tarsi still more nearly so; stigma as on other species, with only a rudiment of submarginal band; peduncle black, abdomen ochreous-yellow to golden yellowish brown, usually a narrow, irregular longitudinal mid-dorsal black band without pronounced lateral projections on the segments.

Head slightly variable in dimensions, from one-twentieth more than half longer than wide to about half as long as wide, face mod-

<sup>9</sup> Amer. Ent. and Bot., vol. 2, no. 10, p. 301, 1870.

erately prominent and rounded between eyes as seen from above, hind edge of head scarcely convex, vertex moderately so; ocellar area finely punctate, malar space smooth, bare; cheeks and temples semi-smooth or feebly strigose, reticulate, face more coarsely reticulate; pedicel almost a fourth as long as scape (not including radicle), slightly longer than F1, latter about a fifth longer than each of F2 to F5, these subequal in length, and each approximately one-fifth longer than thick, club not thicker than flagellum and slightly longer than F4 and F5 combined; pronotum one-tenth narrower than head and almost as broad as mesonotum; pronotum and mesonotum uniformly and rather coarsely umbilicately punctate; anterior lateral half of mesopleura minutely papillose, posterior half aciculate and finely punctate; a row of 13 to 18 setae on submarginal vein, more often about 15; propodeum coarsely and variously reticulate, a broad U-shaped carina limiting groove in front, anterior third of groove smooth and polished, the rest crossed by several subparallel and not quite uniformly spaced rugae; abdomen in part or mostly polished, sometimes posterior portions finely granulose, region of ovipositor sheath punctate and hairy.

*Male*.—Length 1.2 to 3 mm., or in general a bit shorter than female and somewhat slenderer, antennae and scrobe sometimes dusky, and thorax at times slightly blacker than in female, but dimensions, sculpture, and vestiture similar in both sexes; pedicel slightly more than twice as long as wide, not much longer than F1, latter fully twice as long as wide, F2 to F4 not equal, F2 twice as long as thick, sometimes barely so, F3 and F4 alike but slightly less than half as broad as long, these dimensions varying among individuals.

*Type locality*.—Claremont, Calif. (C. F. Baker).

*Holotype*.—Female, U.S.N.M. No. 20400, antennae and a hind leg on a slide.

*Remarks*.—Originally described from this holotype; redescribed from the type, the type of *compressa* Girault, and a series of both sexes from various localities in California. *D. compressa* Girault differs from *subimmaculata* only in being somewhat larger with a few more setae on the submarginal vein, but no differences in dimensions, sculpture, and general color pattern are present. Moreover, the California specimens below that were reared from known gall and oak hosts show a similar variation in size and vestiture, which I take to be adequate evidence for placing *compressa* Girault in synonymy. The types of *subimmaculata* Girault and *compressa* Girault were not reared.

*D. autumnalis* Girault also was described from a single specimen from unknown hosts in California. It has a somewhat darker head than *subimmaculata*, but the thorax is lighter, indicating that the coloration of the former is abnormal. This type has the hind tibiae



infuscated, but is otherwise like *subimmaculata*, and seems to be merely an anomalous specimen of the latter species.

There is a rather pronounced variation in size among the series described below, and the vestiture of the submarginal vein varies numerically somewhat with the size of the specimen, as has been noted in other instances within the genus.

The collection of the United States National Museum contains a series (3767 and 3767<sup>x</sup>) of 17 females and 10 males, all representing the smaller sizes of this species, reared by Albert Koebele from the twig galls of *Heteroecus pacificus* (Ashmead). Koebele reported it from *Quercus pumila*, but Doctor Kinsey informs me that *Q. chrysolepis* is the only known host of *H. pacificus* and that *Q. pumila* is a species of Southeastern United States. The specimens bear dates as follows: September 24 and October 2, 1885, and January 21, 1886. Most of them are not dated. The galls were collected September 9, 1885, at Colfax, Calif. In the same collection is one female reared at Cottonwood, Calif., January 19, and a small, darker male dated February 11, both from a gall on *Q. lobata*. It is probable that these are conspecific despite their differences in color.

Eight males and females, with record numbers 3794a<sup>x</sup>, 3794a<sup>x2</sup>, 3795<sup>x2</sup>, and 3797<sup>x</sup>, were reared by Mr. Koebele at Colfax, Placer County, Calif. The one specimen from 3797<sup>x</sup> was reared January 8, 1886, and the gall received, presumably at Washington, D. C., on October 17, 1885. This female was reported by Koebele from the gall of *Heteroecus dasydactyli* (Ashmead). Kinsey<sup>10</sup> indicates that Ashmead had mixed galls, which probably represented two species, *H. dasydactyli* and *H. melanoderma* Kinsey. Hence, the exact cynipid host for this lot is in question.

The specimens numbered 3794a<sup>x</sup>, and presumably those bearing other combinations of 3794 and 3795, came from an unidentified gall collected by Mr. Koebele at Colfax, Calif., from *Q. chrysolepis* and were received at Washington, D. C., on October 17, 1885. One rearing record is January 20, 1886 (3794<sup>x</sup>). It is highly probable that the maker of these unidentified galls was also a species of *Heteroecus*.

Two specimens (59°) from Placer County, Calif., probably issued January 2, 1886, from a cynipid gall collected October 8, 1885, on *Q. chrysolepis*. Joseph Wade furnished me these data, which accompany record number 59<sup>k</sup>, and probably refer also to this series. Mr. Koebele was perhaps the collector.

In addition I have a series of 10 specimens reared by Dr. A. C. Kinsey from California cynipid galls on *Q. chrysolepis* as follows: El Portal; San Jacinto Mountains, *Andricus spectabilis* Kinsey; Placerville and El Portal, *Heteroecus pacificus pacificus* (Ashmead);

<sup>10</sup> Indiana Univ. Studies No. 53, vol. 9, p. 89, 1922.



Auburn and San Jacinto Mountains, *Andricus lasius subblasius* Kinsey; and Placerville, *A. lasius lasius* Ashmead. The rearing dates of the gall makers fall between February 28 and March 30, 1920.

The following were reared by L. H. Weld in California localities: 1 male from the gall of *Disholcaspis truckeensis* (Ashmead), on *Q. chrysolepis*; a pair (Hopk. U. S. 15613°), July 8 (male) and 15 (female), 1918, from the same species of oak and gall, Camp Baldy, Calif., and a female (1732) from the gall of *Andricus lasius lasius* Ashmead, at Los Gatos. The male of the above pair is distinctly darker than the female.

Two fine lots of typical *subimmaculata* are at hand as follows: 8 females (Hopk. U. S. 15922f) reared by R. D. Hartman, May 21 and June 4 and 11, 1919, from galls of *Callirhytis* sp. (determined Middleton) on *Q. chrysolepis*, at Los Gatos, Calif.; 15 females and 6 males (Hopk. U. S. 15605°) reared by L. H. Weld, July 8, 15, and 23 and November 6, 1919, at Camp Baldy, Calif., from galls of *Andricus pomiformis maculipennis* (Kieffer) on *Q. wislizenii*.

#### 27. DECATOMA PEZOMACHOIDES, new species

Similar to *D. subimmaculata* Girault in color, but may be distinguished by its more robust form; it has 11 to 12 setae on the submarginal vein, the head is very nearly to actually twice as wide as long, and the face seen from above is only feebly rounded.

*Female*.—Length 2.75 mm., form quite robust for the genus, color predominantly golden yellow; head golden yellow, except slightly around mouth, a small blotch contiguous with and scarcely larger than each ocellus, and occiput narrowly, black; scape pale yellow, pedicel same with basal upper third brown, flagellum uniformly pale brownish yellow; neck narrowly black, thorax yellow like head, except a fragmentary dorso-median longitudinal band variable in size and intensity on prescutum and extending forward under pronotum, and lower hind edge of axillae narrowly, black, venter of thorax from middle coxae to and including propodeum, more or less black; legs bright honey yellow, tibiae approaching stramineous-yellow, tarsi stramineous; pedicel black; an irregular dorso-median band usually not extending full length of the abdomen.

Head transversely subrectangulate-ovate, about twice as wide as long, face from above protruding feebly in front of eyes and not sharply set off from eyes, hind edge of head almost straight or feebly concave, vertex moderately convex transversely; malar space behind groove smooth, polished, cheeks same or becoming semismooth above, ocellar area finely punctate, occiput and hind portion of vertex inconspicuously sculptured, face moderately reticulate-punctate, and sparsely hairy; pedicel twice as long as its greatest diameter, only

slightly longer than F1, F1 a fourth longer than F2, funiculars 2 to 5 subequal, becoming more robust from 2 to 5, the second slightly longer than thick, the fifth as broad as long and subquadrate, club at greatest width as broad as F5 and a little longer than F4 and F5 combined, antennae as a whole rather stout and densely hairy; pronotum one-fifth narrower than head, and about one-tenth narrower than mesonotum, these nota moderately and not deeply umbilicated; anterior lateral half of mesopleura feebly, posterior half more coarsely, aciculate, both finely and rather sparsely punctate; 11 or 12 setae on submarginal vein, hairs widely spaced; propodeum coarsely and irregularly netted, groove polished, fairly deep and broad, bottom rounded and crossed by several diagonal unevenly spaced rugae, groove ended in front by an arcuate carina; anterior lateral half of abdomen mostly smooth, polished, but posterior portions in part inconspicuously and minutely granulose, particularly on posterior parts of the segments, abdomen practically bare, except area along ovipositor sheath, which is hairy and finely punctate.

*Male*.—Unknown.

*Type locality*.—Bluffton, Ohio.

*Type*.—Female, U.S.N.M. No. 42245.

*Remarks*.—Known from four females collected by Dr. L. L. Huber. Two were taken at Flint, near Columbus, Ohio, August 15, 1921, and two were reared at the type locality, August 29, 1921, from galls of *Cynips pezomachoides* Osten Sacken (determined Huber), probably var. *erinacei* (Beutenmueller), on *Quercus alba*. Three paratypes are in the writer's collection.

## 28. DECATOMA POMIFORMIS, new species

### PLATE 2, FIGURE 24

Perhaps nearest to *D. subimmaculata* Girault, from which it may be distinguished by characters in the key; furthermore, the head is somewhat broader, and the body is on the average a little longer in the present species.

*Female*.—Length 3.5 to 3.8 mm., fairly robust, colors yellow and black; head golden yellow, oral region faintly brown, occiput rather broadly black, and vertex with a subquadrate black patch not reaching beyond ocelli behind and on the sides, extending to and narrowing toward antennal scrobe; scape a shade lighter than face, pedicel brown above, darker on basal two-thirds, ring joint dull yellow, flagellum chestnut-brown; black of neck sometimes extending caudad as a band more or less upon meson of pronotum but never more than halfway to hind margin, pronotum otherwise concolorous with head; mesonotum often showing black through middle third of pronotum

and with a discal triangle on prescutum, apex of triangle narrowed to a broad mesal longitudinal stripe on posterior half of this sclerite, stripe extending almost to margin, anterior disk of scapulae and at times their lower edge, sometimes lower edge of axillae, often a mesal longitudinal band on anterior half of scutellum, anterior portion of metapleura sometimes, upper front surface and the groove of propodeum, and most of venter of thorax, black; legs bright honey yellow, basalmost parts of front and middle coxae partly, and basal portions of hind coxae in part, black, tibiae and tarsi almost stramineous-yellow; stigma dark brown, a mere rudiment of submarginal band present; peduncle and a dorso-median band with lateral projections on the first four segments, black, abdomen otherwise brownish to ochreous-yellow.

Head from above never quite twice so wide as long, about four-sevenths as long as wide, face feebly rounded and protruding moderately in front of eyes, rather sharply set off from margins of eyes, vertex fairly convex, hind edge about straight transversely; malar space smooth along groove, polished, becoming strigose toward cheek, latter semismooth below, reticulate-punctate above, ocellar area finely and densely punctate, rest of head surface reticulate, sparsely and inconspicuously hairy; scape nearly three times as long as pedicel, latter conical, twice as long as its maximum diameter, and one-fifth longer than F1, F1 one-fourth longer than thick, F2 to F5 subequal, becoming more robust from second to fifth, second only slightly shorter than F1, fifth scarcely longer than broad; head slightly more than a seventh broader than pronotum, and an eighteenth wider than mesothorax; nota of prothoracic and mesothoracic segments umbilicately punctate, moderately hairy, mesopleura aciculate, the posterior half more coarsely, both parts minutely punctate but the front half densely so, 13 to 16 setae on submarginal vein; dorsum of propodeum coarsely and variously rugose-reticulate, the cells more finely sculptured, groove limited in front by a broadly V-shaped carina, apex of carina almost arcuate, groove sculptured much as the other propodeal surfaces, and shallowly rounded; abdomen mostly bare, and polished, shiny, mostly unsculptured, posterior half more or less very finely granulose, hairy, and punctate around ovipositor sheath.

*Male*.—3.5 mm. long, slightly slenderer than female, color darker than female as follows: Occipital black area approaching closer to eyes, and ocellar area black, neck blacker, and a mesal longitudinal band extending from neck to pronotum, band broadening abruptly from middle of pronotum to caudo-lateral corners and thus reaching hind margin of the segment; prescutum and propodeum more largely, outer face of hind coxae, upper disk of hind femora, and dorsum of

abdomen more broadly, black; vestiture, sculpture, and the head dimensions, as described for female.

*Type locality*.—Gaviota, Calif.

*Type*.—Female, U.S.N.M. No. 42246.

*Remarks*.—The known material of this species consists of the type, the allotype, and 11 female paratypes; the first two, with three paratypes and the front wing of a female paratype on a slide, are deposited in the collection of the United States National Museum, and the remainder are in the collection of the writer. All these specimens were reared by Doctor Kinsey from the galls of *Andricus pomiformis rossi* (Kieffer) on California live oak (*Quercus agrifolia*) at Gaviota, Calif., the gall makers issuing on March 5, 1920.

#### 29. DECATOMA QUERCI-LANAE (Fitch)

##### PLATE 2, FIGURE 26

*Spalangia querci-lanæ* FITCH, Ann. Rep. New York State Agr. Soc., p. 816, 1859; 5th Rep. Nox. Ins. New York, p. 36, 1859.

*Decatoma querci-lanæ* ASHMEAD, Trans. Amer. Ent. Soc., vol. 14, pp. 196, 197, 1887.

*Decatoma hyalipennis* WALSH, Amer. Ent. and Bot., vol. 2, no. 10, p. 301, 1870.—PROVANCHER, Additions à la faune hymenopterologique, p. 193, 1887.

*Decatoma simplicistigma* WALSH, Amer. Ent. and Bot., vol. 2, no. 10, p. 301, 1870.

*Decatoma flavicollis* WALKER, Ent. Mag., vol. 2, p. 156, 1834. Original description. A European species.—MAYR, Verh. Zool. Bot. Ges. Wien, Band 55, pp. 532–534, 1905. Redescribed.

*Decatoma flavicollis* ASHMEAD, Trans. Amer. Ent. Soc., vol. 12, p. xiii, 1885. An American species.

*Decatoma floridana* J. B. SMITH, Ent. Americana, vol. 2, p. 19, 1886. New name for *flavicollis* Ashmead.

*Decatoma michiganica* GIRAULT, Proc. U. S. Nat. Mus., vol. 58, p. 209, 1920.

Similar to *foliatae* Ashmead in size, form of the head, and number of setae on the submarginal vein, but differs from it in having even the coxae all yellow and the thorax with a more or less developed irregular dorso-median longitudinal black band, while *foliatae* has most of head, the prescutum, scutellum, propodeum, and most of abdomen black. Specimens having scapulae more or less black are being regarded as *foliatae*.

*Female*.—Length, 2.5 to 3.5 mm., mostly about 3 mm.; fairly robust, colors yellow, brownish yellow, and black, relative degrees of each variable; head and thorax honey yellow; scape almost concolorous with head, basal two-thirds of pedicel brown-black, its apex honey yellow, flagellum chestnut-brown; head with only vertex and occiput black; black of vertex narrowly, or sometimes barely, inclosing ocelli, or sometimes extended to include disk of vertex but very rarely reaching eyes laterad or farther than apex of antennal scrobes or

hind edge of head; occiput usually mostly black, this not uncommonly broadening toward but seldom reaching the vertex except by a narrow, or rarely a broad, longitudinal median band, the band sometimes extending caudad varying in width and length, occasionally reaching hind edge of pronotum; mesonotum rarely almost immaculate, usually with a median longitudinal black band varying in width at different points and in a series of specimens, often broadened especially on prescutum, sometimes enlarged to a triangle almost coextensive with borders of prescutum and extending forward under pronotum, band more regular on scutellum, almost always full length of the sclerite, and usually not broader than half the width of this area, scapulae and axillae immaculate, rarely in part infuscated, sterna of thorax black mostly between coxae only; anterior portion and groove of propodeum black, often feebly so; legs yellow, coxae concolorous with sides of thorax, rarely the hind pair feebly and partly blackened, femora slightly lighter, tibiae light yellow, tarsi stramineous; stigma brown, submarginal band lacking; peduncle black, dorsal area of abdomen narrowly to broadly black with pointed projections extending toward middle of sides, abdomen otherwise ochreous-yellow.

Head three-fifths as long as broad from above, face broadly rounded, eyes not abruptly separated from front, vertex feebly convex, hind edge of head almost straight; ocellar area finely punctate, malar space smooth, polished, rest of head moderately reticulate-punctate and sparsely and inconspicuously hairy; about two-thirds as long as pedicel and a fifth longer than each of F2 to F5, latter joints subequal, scarcely longer than broad, club not quite so long as F3 to F5 combined, flagellum rather densely hairy; pronotum slightly narrower than head and mesothorax; pronotum, prescutum, and scutellum moderately umbilicately punctate and hairy, mesopleura aciculate and finely punctate; 12 to 14 setae on submarginal vein; groove of propodeum crossed by a rounded carina in front and by feeble rugae on posterior two-thirds; abdomen polished, sparsely hairy on the sides, moderately hairy and punctate in the region of the ovipositor sheath.

*Male*.—The male of this species is extremely variable in color. One color variety is being recognized in this sex in addition to the lighter form described herewith.

Like the female in general, except on the average slightly darker, the occipital black space usually larger, the scapulae, hind coxae, and abdomen more often partly and more extensively black; pedicel a fourth longer than F1, latter twice as long as wide, F2 to F4 equal in width and subequal in length, about five-sixths as long as F1, club slightly longer than F3 and F4 combined.

*Type locality*.—New York State (Asa Fitch).

*Type*.—Female, U.S.N.M. No. 1832.

No other type material in the United States National Museum collection.

*Remarks*.—Redescribed from the type, the types of synonymous forms, and a series of specimens from various regions in the eastern half of the United States.

Ashmead pointed out that *D. hyalipennis* Walsh is conspecific with *querci-lanae* (Fitch). He likewise showed that *D. simplicistigma* Walsh is also this Fitch species, but only established the identity of Walsh's species with *dorsalis* (Fitch), a dark color variety of *querci-lanae*. There are present, in addition to the dark specimens, typical light-colored forms of *simplicistigma* that agree fully with the Fitch type and check with the descriptions of the typical *querci-lanae*. A comparison of the above forms and the available rearing data leave no doubt about the correctness of Ashmead's conclusions that *simplicistigma* and *querci-lanae* are conspecific.

Professor Smith placed *flavicollis* Ashmead in synonymy, renaming the species *floridana* in view of the preoccupation of the name by *flavicollis* Walker. *D. floridana* is no doubt just another lot of *querci-lanae* (Fitch). All the type specimens, except one, are males. The female is a good *querci-lanae*, and the males mostly come close to variety *dorsalis* (Fitch), and agree in color variation with series since reared from galls of *Andricus flocci* (Walsh) on *Quercus alba*, the hosts of the types of *querci-lanae*.

Similarly, *michiganica* Girault, represented in the United States National Museum collection by the type and a paratype, both females, are true *querci-lanae* (Fitch), agreeing in all essential respects with the typical light color form of this species.

No other species of this genus has perhaps been collected and reared so commonly as this one. Following are the records at hand: The female type alone remains of a series reared by Doctor Fitch in New York State from galls of *Andricus flocci* (Walsh) (*Cynips quercus-lana* Fitch); Walsh's series (*simplicistigma*) came from galls of *Cynips pezomachoides* Osten Sacken and *Biorhiza forticornis* (Walsh), both on *Q. alba*, and *A. petiolicola* (Bassett) on swamp white oak (*Q. bicolor*), all presumably from northern Illinois; Ashmead's *floridana* (*flavicollis*) specimens were "bred from an undescribed *Cynips* gall," Jacksonville, Fla.; and the Girault types of *michiganica* are from a "white oak woolly twig gall" (Acc. Cat. 737, Agr. Coll. Mich., June 27–28 and July 9, 1887) in Michigan; another Ashmead series from Jacksonville, Fla., has on several pins the label "*N. (Neuroterus) majalis*, on *Q. alba*"; a few old specimens are labeled "*A. flocci*," and Doctor Kinsey reared a large series, both sexes, from a variety of this gall as follows: Jacksonville, Tex., *Q. stellata*; Big

Stone Gap, Va., *Q. alba*; a few from galls of *A. aciculatus* Beutenmueller on *Q. stellata*, Austin, Tex.; and one, same, from Yoakum, Tex.; the gall makers of these Kinsey lots issued between October 25 and December 4, 1919. Several specimens dated June 29, 1924, from galls of *A. petiolicola* var. on *Q. bicolor* at Winona Lake, Ind., were collected by F. Payne and sent me through Doctor Kinsey; I have reared a female from the stem gall of *Disholcaspis mamma* (Walsh) on *Q. macrocarpa*, Urbana, Ill., May 23, 1924, and 3 females issued March 21, 1929, from galls of *D. globulus* (Fitch) collected on and under *Q. michauxii* at Catlin, Ill., on February 24, 1929; a female (463°) reared by J. W. Lloyd, Cincinnati, Ohio, on June 24, 1895, from gall of *Neuroterus saltatorius*?; several females (3126<sup>01</sup>) from *N. batatus*? (*Cynips q-batatus*?), on *Q. alba*, June 30, 1883, Virginia, by Theodore Pergande; 2 (2610°) issued May 4, 1882, from cynipid galls received at Washington, D. C., on March 23, and collected from oak by H. K. Morrison at Fort Grant, Ariz.; another (2744°) with same data as preceding issued in transit to Washington, D. C., and was received on June 12, 1882; a female (189<sup>80</sup>) came from Cadet, Mo., where it was presumably reared on February 10, 1883; 3 females (158<sup>x</sup>) on multiple point mount are from J. W. Letterman, Allenton, Mo., *A. flocci* (Walsh), *Q. alba*, February 14; 2 from oak, Washington, D. C., May 12, 1895; 1 Biscay Bay, Fla., 2 from Texas (Belfrage); 2 from New Brunswick, N. J.; 1, 'probably from a gall, is dated October 27, 1876; another (17<sup>x</sup>) from oak gall, St. Louis, Mo., C. V. Riley; A. T. McClay reared a female from an unidentified gall at Hillview, Ill., April 6, 1928; L. H. Weld reared and sent me a small series of each of the following from cynipid galls, the numbers in parentheses being Weld's record numbers; Evanston, Ill. (210), *Callirhytis scitula* (Bassett), *Q. coccinea*; same locality (209), *C. tumifica* (Osten Sacken), *Q. borealis*; same place (21), *C. seminator* (Harris), on *Q. alba*; Moline, Ill. (168), *C. flavipes* (Gillette), *Q. macrocarpa*; Winnetka, Ill. (35), *Acraspis erinacei* Beutenmueller, *Q. alba*; Iron-ton, Mo. (660), *Andricus pattoni* (Bassett), *Q. stellata*; and East Falls Church, Va. (1124), *A. murtfeldtae* Ashmead, *Q. stellata*. I find in the National Museum collection one female (Hopk. U. S. 14636<sup>b</sup>) reared from a gall, determined by William Middleton as a *Callirhytis* sp., on *Q. alba*, at East Falls Church, Va., April 27, 1920. It has the color and form of the typical *querci-lanae*, but departs strangely in possessing a faint band on the wing. This is distinctly narrower than the length of the marginal vein and more than twice as long as broad. Such instances of the occasional occurrence of a band on wings of a species typically lacking it are rare in material accumulated to date.

A single female (Hopk. U. S. 15639<sup>c</sup>), reared by L. H. Weld, February 3, 1922, at Oracle, Ariz., supposedly from a cynipid gall, on



*Q. arizonica*, has the legs in part lightly clouded, but is otherwise a typical *querci-lanae* (Fitch).

30. *DECATOMA QUERCI-LANAE* var. *DORSALIS* (Fitch)

*Spalangia querci-lanae* var. *dorsalis* FITCH, Ann. Rep. New York Agr. Soc., pp. 816-817, 1859; 5th Rep. Nox. Ins. New York, p. 36, 1859.

*Decatoma querci-lana-dorsalis* (FITCH), Ann. Ent. Soc. Amer., vol. 7, p. 8, 1914.

*Decatoma querci-lanae* ASHMEAD, Trans. Amer. Ent. Soc., vol. 14, pp. 196, 197, 1887.

Differs from the lighter form by its smaller size and in having the head always continuously black from vertex to occiput, and the rest of the body generally blacker.

No such dark forms are known in the female sex.

*Male*.—Length, 1.9 to 2.5 mm., mostly intermediate size, relatively slender, colors black and yellow, black predominating; in extreme black specimens, head black except oral area and narrow circum-ocular ring, otherwise degree of yellow variable, the ocular ring sometimes dilating to include cheeks and temples and yellow of oral area extending to occiput behind and up the face to antennal fossae or higher, but vertex almost always entirely black from antennal scrobe to ocular band, black area of vertex always broadly continuous with that of occiput, latter also entirely black; antennae colored as on lighter males, and the females; pronotum of darkest specimens with an almost square black area full length of median third, and rest of sclerite lemon yellow; but median black space sometimes not so long as pronotum and not so broad as median third of this segment, and sometimes hind edge of pronotum narrowly yellow or with a somewhat rounded yellow area; on one specimen the lateral thirds black, these separated from mesal black area only by a fine oblique line of yellow on each side; mesothorax usually mostly black, sometimes entirely so with only tegulae yellow brown, mesopleura occasionally with yellow patches, more often scapulae and axillae in part brown yellow, rarely a yellow line or narrow band in each parapsidal furrow and continuing caudad over lateral thirds of scutellum; metathorax and propodeum almost always entirely black, occasionally a yellowish patch on metapleura; legs mostly yellow, coxae almost always more or less black, hind pair mostly so, disks of middle femora and tibiae sometimes lightly infuscated, those of hind legs darker still, rarely entirely black, peduncle black, abdomen likewise, frequently shading to brown black on ventral half.

Dimensions of head and funicular segment, and sculpturing and vestiture as in lighter form males.

*Type locality*.—New York State.

*Type*.—Male, U.S.N.M. No. 1833 (Dr. Asa Fitch).

No other type material has been found.



*Remarks.*—Redescribed from the type and a good series of reared specimens from various localities in the eastern half of the United States and Texas.

*D. querci-lanae* var. *dorsalis* (Fitch) represents a unique color phenomenon in the genus. Sufficient intergrading variations between the lighter male and variety *dorsalis* occur to show that they are conspecific. The specimens that have the black of the vertex and occiput interrupted, namely the lighter form, are not more numerous than variety *dorsalis*, and among the latter the majority approach the extreme black state rather than the lighter male form. Fitch (loc. cit.) states: "Specimens frequently occur, so very different in their colors that they might almost be deemed a distinct species." The sex of his specimens thus described is not given, but his decision to regard *dorsalis* as a variety proved sound in view of subsequent rearings. First, no mostly black females have been taken to date that can be placed in variety *dorsalis*; and second, I find several instances in which only the *dorsalis* variety of males and the typical light-colored females were reared from the same lot of galls.

A further point of interest is the occurrence of similar mostly black males in *foliatae* Ashmead, *foliatae arizonica*, new variety, and *quinqueseptae*, new species, in addition to a lighter-colored form, as in *querci-lanae* (Fitch). On the other hand, *D. wiltzae*, new species, is mostly black in both sexes, and its male has the colors and pattern of variety *dorsalis* (Fitch). So similar are the males of these species that to date no means of distinguishing them has been discovered. This similarity extends also to size, dimensions, sculpture, and vestiture, but the differences between the females, supplemented by some distinctions in host relations, constitute good reasons for regarding these species as distinct. The only present hope of determining the black males of these several species is to rear them with the females from known oak and cynipid hosts.

Variety *dorsalis* has been obtained from most of the sources named under the typical *querci-lanae*. Only the localities need to be named here, the dates, oaks, and cynipids being as already detailed: Winona Lake, Ind., Urbana and Catlin, Ill., Jacksonville and Yoakum, Tex., Michigan Agricultural College, Texas (Belfrage), and Jacksonville, Fla. [*N. majalis* (Bassett)]. Additional records are: One from "oak wool gall," *Andricus flocci* (Walsh), labeled "Illinois," emerged November 16, 1908; one (158<sup>x05</sup>) was collected by Mr. Koebele, February 1, 1883, on *Q. macrocarpa*, Washington, D. C.; one taken in April, Riley County, Kans., by Doctor Marlatt; one from gall of *Callirhytis tumifica* (Osten Sacken), at Braintree (near Boston, Mass., July 6, 1918, determined by Doctor Kinsey; one (Quaintance No. 24477) collected by H. K. Plank, November 17, 1924, Wagners Ferry, La.; two from J. G. Barlow, Cadet, Mo., collected May 3,

1885, "on buds of white oak"; and data are at hand for a Michigan specimen (Agr. Coll. Mich., Acc. Cat. 592c) reared May 20, 1888, from the gall of *Neuroterus noxiosus* (Bassett) on "swamp oak."

31. DECATOMA QUINQUESEPTAE, new species

Near *D. foliatae* Ashmead in having the yellow on the prescutum variable and the scutel almost always entirely black, and in the number of setae on the submarginal vein; *D. quinqueseptae* is somewhat larger and less robust, and differs most conspicuously in having most of the sides of the abdomen ochreous-yellow, whereas these are entirely dark in *foliatae*.

*Female*.—Length 2.4 to 2.7 mm., colors yellow and black; head black, only narrow ocular band with sometimes an oblique projection from it on vertex toward scrobe, and oral area, labium, and space below antennal fossae and between malar grooves more or less, yellowish brown; scape lemon yellow, its radicle yellowish brown, pedicel dark brown outwardly, only small part of apex lighter, flagellum uniformly light chestnut-brown; pronotum mostly lemon yellow, black of neck extending caudad and forming subquadrangular patch on middle third of pronotum and occasionally reaching hind edge, usually leaving narrow border of yellow on hind edge of pronotum; mesonotum mostly black, parapsidal grooves rather broadly, and posterior part of side of, or more often more than posterior half of scapulae, yellowish orange, tegulae light brown, upper edge of pleura brown, scutel, axillae, metanotum, propodeum, and venter of thorax, black; legs mostly immaculate lemon yellow, only base of coxae sometimes narrowly black, and tarsi stramineous-yellow; stigma dark brown, faint rudiment of submarginal band present; peduncle black, upper two-thirds of first abdominal segment black to brown, lighter beneath, upper third of second segment brown black, lower edges of dark areas irregular, dorsum of posterior half of abdomen lightly infuscated, and most or all of its lateral surfaces and venter ochreous-yellow.

Head from above three-fifths as long as its maximum width, face rather well-rounded transversely between eyes, more prominent dorso-ventrally, eyes and face not abruptly set apart at their junction, vertex moderately convex, hind edge of head feebly convex, hence head not approaching rectangulate-ovate from above; lower portion of genae and most of malar space polished, shiny, upper part of cheeks becoming strigose-reticulate, ocellar area finely punctate, also bearing small umbilicate punctures, rest of head more coarsely reticulate-punctate, and moderately hairy, antennae more densely hairy; pedicel scarcely twice longer than its maximum thickness, conical, about a fourth longer than F1, F1 nearly a fifth longer

than each of F2 to F5, latter joints uniform in dimensions and barely longer than wide, club as thick as funicular joints, tapering to a blunt tip, and slightly longer than F4 and F5 combined; pronotum and mesonotum rather coarsely umbilicate, anterior-lateral sclerite of mesopleura densely papillose, posterior area aciculate-punctate, polished; propodeum coarsely reticulate, or rugose, groove limited in front by a rounded carina, and with a polished depression in anterior portion; 12 or 13 setae on submarginal vein; abdomen polished, smooth, with only small parts granulose, area of ovipositor sheath densely and rather coarsely punctate, hairy.

*Male*.—Length 2.2 to 2.5 mm., fairly slender, blacker than female; head black, except oral area narrowly brown, scape sometimes dusky; sides of pronotum yellow, the yellow area emarginate in front and below, rest of thorax, the propodeum and peduncle, black, legs lemon yellow except basal half to two-thirds of coxae black; abdomen brown-black above, shading to brown on the sides; funicular joints not much longer than broad. In proportions of the head, sculpture, and vestiture of the submarginal vein, the two sexes are alike.

*Type*.—Female, U.S.N.M. No. 42244. Alpine, Calif. (A. C. Kinsey).

The allotype is with the type in the collection of the United States National Museum.

*Remarks*.—Described from the type, allotype, and 12 male and female paratypes reared by Dr. A. C. Kinsey in the type locality from the galls of *Plagiotrochus quinqueseptum* var. on *Quercus engelmanni*. The gall maker issued on February 24, 1920.

All the males of this species at hand are predominantly black, resembling closely the dark variety *dorsalis* of *D. querci-lanae* (Fitch). The females are darker than those of *querci-lanae*, but do not reach the degree of blackness present in the male of either of these two species.

### 32. DECATOMA FOLIATAE Ashmead

*Decatoma foliatae* ASHMEAD, Can. Ent., vol. 13, no. 6, p. 136, June, 1881.

*Decatoma batatoides* ASHMEAD, Can. Ent., vol. 13, no. 6, p. 136, June, 1881.

*Eudecatoma batatoides* ASHMEAD, Trans. Amer. Ent. Soc., vol. 21, p. 319, 1894.

(*D. batatoides* Ashmead designated type of new genus *Eudecatoma* Ashmead.)

Differs from the light-colored *querci-lanae* (Fitch) in having vertex and occiput continuously black, prescutum and scutellum usually entirely so, also propodeum and mesopleura black; the dark males of *foliatae* are similar in degree and arrangement of black and yellow, to *querci-lanae* var. *dorsalis* (Fitch); these species are similar

in size, number of setae on submarginal vein, and in coloration of the legs.

*Female*.—Length 2.8 to 3 mm., fairly stout, colors yellow through reddish yellow to black; head color variable; occiput, vertex, and face at least down to antennal fossae always continuously black, sometimes as far as oral area, all or only upper portion of malar space black, and occasionally also hind portion of cheeks from malar space to occiput, temples more or less brown yellow, circumocular band and sometimes also an oblique stripe from it to scrobe, yellow, ocular band often broadening on face, edges of antennal scrobe usually narrowly yellow; scape dull yellow, basal two-thirds of pedicel brown, apex lighter, flagellum chestnut-brown; neck and front portion of mesal third to all of mesal half of pronotum, black; mesonotum at times entirely black, at least prescutum and scutellum black, their lateral margins sometimes brown-yellow, scapulae and axillae variously brownish or reddish yellow, in extreme cases almost entirely so but at least hind part of axillae black, mesopleura black, with upper edge adjoining tegulae sometimes yellowish, metathorax and propodeum black; legs yellow, coxae sometimes in part black, the inner and outer surfaces of hind pair more so; stigma of wings brown, only a rudiment of a submarginal band present; peduncle black, abdomen mostly brown-black, venter and posterior-lateral areas brown.

Head from above about three-fifths as long as broad, face only feebly protruding and rounded, temples not prominent, hind edge of head almost straight transversely, vertex moderately convex, eyes not sharply set off from vertex and face, hence, head subrectangulate-ovate; malar groove polished, cheeks feebly reticulate punctate, rest of head more coarsely so, but ocellar area more finely punctured, head inconspicuously and rather sparsely hairy; antennae moderately hairy, pedicel almost a third as long as scape, and about a fourth longer than F1, latter approximately a fifth longer than each of F2 to F5, latter subequal in length and diameter, each only slightly longer than broad, club slightly thicker than funicular joints and somewhat longer than F4 and F5 combined; prothorax almost one-seventh narrower than head, and almost as broad as mesothorax, pronota and mesonota coarsely umbilicately punctate, moderately hairy, mesopleura finely papillose on front half, aciculate-punctate on posterior half; propodeal groove broad, shallow, anterior third polished, limited in front by a sharply curved carina, surface of propodeum as a whole irregularly and rather coarsely reticulate-rugose; 12 to 14 setae on submarginal vein; abdomen polished, smooth and bare except area of ovipositor sheath, which is punctate and hairy.

*Male*.—Length 2.5 to 2.9 mm., rather slender compared with females, distribution and relative degrees of yellow and black much as described for *querci-lanae* var. *dorsalis* (Fitch), as follows: Head black, a narrow ocular band and a short oblique stripe from it toward antennal scrobe, and oral area not up to antennal fossae, brownish yellow; scape dull yellow, pedicel brown on basal two-thirds, its apex lighter, flagellum brown on one specimen and yellowish on another, probably usually chestnut-brown; neck black, pronotum with a black rectangle on mesal third or more, its sides dull lemon yellow, mesothorax black, but sometimes hind portion of scapulae, pleura just below tegulae, and tegulae, brownish yellow; metathorax, propodeum, and peduncle black; legs a slightly lighter shade of yellow than sides of pronotum, except front and middle coxae blackish at base, darker on the anterior surface, hind coxae entirely blackish except apical fifth and small part of hind surface feebly brown yellow, stigma brown, band rudimentary; abdomen brown-black above and on most of lateral surface, venter brown.

Pedicel twice as long as thick and slightly longer than F1, F2 to F4 subequal in length and diameter, each about one-half longer than thick, the flagellum moderately hairy; male otherwise like female in dimensions of head, vestiture, and sculpture.

*Type locality*.—Jacksonville, Fla. (W. H. Ashmead).

*Type*.—Female, U.S.N.M. No. 2819.

*Remarks*.—The type, allotype, and a series of mostly female paratypes were used in preparing the redescription of the species. A few nontypes are at hand. Among these are two females received from L. H. Weld, who reared them from galls of *Callirhytis flavipes* (Gillette) at Moline, Ill.

The lots listed below bearing Hopkins numbers are of special interest because they resemble the darker specimens of *D. querci-lanae* (Fitch). Here, as in the *nigriceps-globuli-dubia* series, as well as in the *florida-occidentalis* group, there appears to be an intergrading of characters, with the result that arbitrary color marks of doubtful value need to be adopted to separate *foliatae* from *querci-lanae*. Some of the present Hopkins specimens have only a small black patch on the scapulae, which with the rather broad black mid-dorsal band on the mesonotum, and the almost dark vertex, is regarded as a recognition mark of *foliatae*. I suspect that eventually a complete color series ranging from the lighter, mostly yellow *querci-lanae* to the darker, mostly black *foliatae* may be found when large numbers have been reared from different localities in the distributional limits of these species. Some of the Hopkins specimens are from galls of *Disholcaspis*, whereas all other *foliatae* known to date are from other cynipid genera. Most of the *querci-*

*lanae* material at hand is from *Andricus* galls, although other cynipid genera are represented among its hosts. The Hopkins lots are as follows: 1 female (Hopk. U. S. 13685<sup>e</sup>) from gall of *Disholcaspis globulus* (Fitch) on *Quercus alba*, reared April 5, 1918, at Falls Church, Va., by William Middleton; a pair (Hopk. U. S. 15633<sup>a</sup>), reared by L. H. Weld from unidentified gall on *Q. chapmani*, May 26, 1920, Clarabella, Fla.; 2 pairs (Hopk. U. S. 10773<sup>a</sup>) from the galls of *D. fasciata* Bassett on *Q. velutina*, May 14, 1919, Falls Church, Va., and 1 pair (Hopk. U. S. 10777<sup>b</sup>), reared by S. A. Rohwer on May 21 (female) and 14 (male), 1919, from undetermined galls on *Q. minor* at Poplar Bluffs, Mo. The males are all mostly black and have the characteristics of variety *dorsalis* of *querci-lanae* (Fitch).

After repeated study I conclude that *batatoides* Ashmead is identical with his species *foliatae*. The general color scheme and the limits of color variation are alike in the two lots, and no differences in head dimensions, sculpture of the malar space, cheeks and abdomen, nor in the number of setae on the submarginal vein, can be found to justify retaining them as two species. Ashmead, in his description of *batatoides*, says it "very much resembles *foliatae* \* \* \* in punctuation and shape," and points out that they may be easily distinguished by size and color. But there are no such size and color differences in the types of the two Ashmead species. His description of *batatoides* does not mention some outstanding color aspects found on the specimen designated by him as the type. The type (female) and allotype are certainly identical with his *foliatae* types. *D. foliatae* Ashmead was reared by Ashmead "from leafy live oak gall," *Andricus foliatus* (Ashmead) (*Cynips q. foliatae* Ashmead), and *D. batatoides* Ashmead was reared by the same worker "from live oak potato gall," *Plagiotrochus batatoides* (Ashmead) (*Cynips q. batatoides* Ashmead). The live oak mentioned is probably *Quercus virginiana*. Both series are from Jacksonville, Fla. These galls are very different in structure, yet this *Decatoma* could live within each as a parasite. Could it be that these galls will prove to be alternate seasonal forms of one species?

### 33. DECATOMA FOLIATAE ARIZONICA, new variety

#### PLATE 2, FIGURE 23

Not distinguishable from *D. foliatae* Ashmead in the range of variation in the color of the head, pronotum, and mesonotum; the females of variety *arizonica* in the series at hand have the sides of the abdomen mostly brown yellow to ochreous-yellow, whereas these are darker in *foliatae*; specimens of the variety *arizonica* at hand differ also in being from 3.1 to 3.3 mm. long and in having 14 to 16

setae on the submarginal vein as contrasted with a length of 3 mm. and 12 to 14 setae on the latter vein in *foliatae*. Both these lots are from cynipid galls on live oak, and when more specimens are reared they may not prove to be separable in the respects stated above, despite the difference in geographical distribution.

*Type*.—Female, U.S.N.M. No. 42243, from Fort Grant, Ariz.

*Remarks*.—In addition to the type and the allotype, this variety is represented by 5 female and 2 male paratypes reared at Washington, D. C., on April 5, 1882, from unidentified cynipid galls received March 24, 1882, and collected from live oak by H. K. Morrison at Fort Grant, Ariz. Some of the paratypes occur in the writer's collection; the rest, together with the allotype, are in the National Museum. The specimens bear numbers 2634<sup>0</sup>, 2634<sup>02</sup> and 2634<sup>03</sup>. One female (Hopk. U. S. 15604<sup>c</sup>), which I have determined as this variety, was reared by L. H. Weld, April 29, 1918, from a gall of *Callirhytis ruginosus* (Bassett), at Prescott, Ariz. Mr. Weld had galls of this species from *Q. grisea* and *arizonica*.

#### 34. DECATOMA WILTZAE, new species

Nearest to *D. marylandica* Girault in being mostly black, but has the front and middle legs blacker, is distinctly smaller, and the head is more robust.

*Female*.—Length 2 mm., fairly robust, color mostly brownish black, some parts yellow; head brownish black, oral space around base of mandibles brownish yellow; scape concolorous with face, apex of pedicel yellowish, rest like scape, funicular segments (specimens imperfect) yellowish and lightly infusate, especially above; thorax, including tegulae, deep brownish black, slightly darker than head, upper front corner of pronotum with a triangular patch of lemon yellow; front and middle coxae mostly, hind coxae entirely, outer disks of front and middle, and all of hind femora and tibiae, dark brown, except ends narrowly; legs otherwise yellow, tarsi light, approaching stramineous; stigma dark brown, submarginal band rudimentary, propodeum, peduncle and abdomen brown black.

Head two-thirds as long as broad, subglobose, broadening behind, face from above feebly protruding beyond eyes, receding rather sharply below antennal fossae, eyes and face moderately set off at their junctions, hind edge of head broadly, vertex more sharply, convex; malar space behind groove, and cheeks entirely smooth, polished, bare, numerous small umbilicate punctures on vertex and occiput, face subreticulate and moderately hairy; pedicel half as long as scape, two and a half times as long as its own diameter at apex, and more than twice as long as F1. F1 not so broad as and slightly longer than F2, F2 and F3 each scarcely longer than wide, rest of antenna not present, but F4 and F5 probably as broad as long; head

only a twelfth broader than pronotum, and as broad as mesothorax; umbilicate impressions of pronotum and mesonotum shallow and indistinct, these nota rather sparsely hairy, anterior half of mesopleura shagreened, posterior portion feebly aciculate and minutely and sparsely punctate; about 12 setae on submarginal vein; propodeal surface rather feebly and variously rugose, the groove broad, moderately concave transversely, and not prominently sculptured, limited in front by V-shaped carina, apex of V acute, more so than in other species studied; abdomen highly polished, smooth, and bare, except posterior face around ovipositor sheath, which is conspicuously hairy.

*Male*.—Length 2 mm., slenderer and legs blacker than female, color otherwise more variable; only oral area yellowish as on the female, or face almost up to antennal fossae, circumocular band broadly below and narrowly above, and a stripe from each eye obliquely toward scrobe, ochreous-yellow; lateral surfaces and hind edge of pronotum, and a pair of subparallel lines on lateral thirds converging toward front margin, yellow; mesothorax black, sometimes upper part of mesopleura and lower edges of scapulae, axillae and scutel, yellow brown; legs as on female but the brown black of middle legs both more extensive and intense; propodeum, peduncle, and abdomen brown black.

Head not so robust as on female, not quite two-thirds as long as broad, sculpture of head, mesopleura, and abdomen as on female, but carina limiting front of propodeal groove with rounded apex on one specimen; 12 or 13 setae on submarginal vein; ratio of scape and pedicel as in female, F1 a third longer than thick, F2 a fifth longer than wide, rest of antennae lacking, but F3 to F4 probably only slightly longer than wide.

*Type locality*.—Pasó Robles, Calif.

*Type*.—Female, U.S.N.M. No. 42247.

*Remarks*.—Described from the type, the allotype, and two male paratypes. The allotype is placed with the type in the National Museum and the paratypes are in my collection. All these were reared by Dr. A. C. Kinsey at the type locality from the galls of *Andricus wiltzae* Fullaway on *Quercus lobata*. The cynipid gall makers issued on March 7, 1920.

Later I find six females (Hopk. U. S. 15608<sup>a</sup>) reared by L. H. Weld on June 5 and 17, 1918, from undetermined galls on *Q. suber*, at San Jose, Calif. They range from 1.6 to 2.3 mm. in length, the head dimensions vary from five-ninths to two-thirds as long as broad, head rounded, subglobose, and the setae on the submarginal vein number from 11 to 13, mostly 12. This lot agrees with the types also in the following essential respects: F2 to F5 subequal, all about as broad as long, but becoming gradually larger toward club, face and



genae subreticulate, except cheeks along lower hind edge of eye smooth, polished, malar space feebly strigose; anterior lateral portion of mesopleura shagreened, hind part aciculate punctate, anterior end of propodeal groove limited by a V-shaped carina, sides of abdomen entirely unsculptured and highly polished, smooth. The body is entirely black, only the front upper-lateral corners of pronotum are brown yellow; legs variable in color, front and middle coxae yellow to entirely infuscate, hind coxae always black, femoral and tibial disks of all legs more or less black, those of front pair feebly to those of hind legs entirely so. The agreement of this series with the types is so close that I am certain that these are the same species even in the absence of host records for the latter lot. The dimensions of the funicular joints in this series of specimens confirms my descriptions of these joints in the imperfect types.

Six females and four males (Hopk. U. S. 15600<sup>d</sup>) were obtained on April 22, 24, 25, and 29, 1918, from galls taken at Flagstaff, Ariz. According to the data on the pins these came from galls on *Rhodites fusiformans* Ashmead on *Rosa* sp. The rearing records accompanying the specimens from these galls, however, do not coincide with the data on the pins. Aside from the confusion in the records, it is quite unlikely that a *Decatoma* known from an oak gall would also inhabit galls on plants so far removed in relationship as the rose. I have studied these specimens repeatedly with great care and am satisfied that they are *Decatoma wiltzae*. I find no characters that are at variance with the essential features of the other specimens at hand. It is probable that the host is a gall on oak.

### 35. DECATOMA MARYLANDICA Girault

#### PLATE 2, FIGURE 25

*Decatoma marylandica* GIRAULT, Bull. Brooklyn Ent. Soc., vol. 2, p. 112, 1916.

Resembles *D. florida* Girault in being mostly black; but *florida* has head twice as wide as long, only the anterior-lateral corners of the pronotum yellow, and legs yellow except coxae, which are black; in *D. marylandica* the head is about three-fifths as long as wide, lateral surfaces of pronotum yellow full length, but narrowly on posterior half, and at least the hind femora and tibiae black.

*Female*.—Length 2.5 to 3 mm., fairly robust, color mostly black; head black, with fine ocular ring of yellow-brown, labium and palpi yellowish white; scape and pedicel lemon yellow, but basal two-thirds of latter brown above, F1 to F3 dusky, F4, F5, and club light chestnut brown; pronotum black, anterior-lateral half broadly and posterior half narrowly yellow, lower edge of notum black; rest of thorax and propodeum black, tegulae brown; front and middle legs lemon yellow, except base of coxae and outer femoral disks, which

are faintly brown or brown black, middle pair somewhat darker, basal four-fifths of hind coxae black, the femora and tibiae brown black, except base and apex narrowly, tarsi almost stramineous, other parts of legs lemon yellow; stigma dark brown; peduncle and most of abdomen black, or abdomen in part brownish black on the sides.

Head three-fifths to four-sevenths as long as broad, face protruding rather strongly beyond eyes, well-rounded and distinctly set off from eyes, vertex feebly convex above transversely, back edge of head almost straight; all of vertex finely and densely punctate, with sparse small umbilicate punctures, malar space smooth, shiny, cheeks finely strigose-punctate, scantily hairy, face reticulate-punctate, moderately hairy; pedicel a fourth longer than F1, latter slightly longer than F2, F2 to F5 subequal in length, each only slightly longer than thick; mesothorax almost as broad as, and pronotum about one-sixth narrower than, head; pronotum and mesonotum coarsely punctate, punctures umbilicate and almost contiguous, anterior half of mesopleura finely and densely pitted, posterior half aciculate-punctate; propodeal surface rather coarsely and variously reticulate, groove broad, its bottom rounded and rugose, the anterior fourth smooth, shiny, groove limited anteriorly by a broadly V-shaped carina with rounded apex; submarginal vein with about 16 setae; abdomen polished and smooth, and bare except moderately hairy along ovipositor sheath.

*Male*.—Unknown.

*Type locality*.—Glenn Dale, Md.

*Holotype*.—Female, U.S.N.M. No. 20364.

Originally described from the holotype, and presumably also another female from oak at Washington, D. C., which Mr. Girault had at hand. The holotype was collected at large in a woods on June 26, 1916. Two additional females were sent me by Dr. J. McDunnough from the entomological collections of the Canadian Department of Agriculture, Ottawa. These agree in every way with the type and the Washington specimen, and issued June 3, 1911, from the galls of *Neuroterus batatus* (Fitch). The galls were collected by H. G. Payne at Bear River, Nova Scotia. This is the oak potato gall, and appears on white oak (*Quercus alba*).

### 36. DECATOMA FLORIDA Girault

*Decatoma florida* GIRAULT, Descriptiones hymenopterorum chalcidoidicarum variorum cum observationibus, pt. 5, p. 6, 1917; Proc. U. S. Nat. Mus., vol. 58, p. 208, 1920.

Most like *marylandica* Girault from which it may be distinguished by characters given before the description of that species.

*Female*.—Length 3 to 3.1 mm., fairly robust, body almost entirely black; head black except a narrow ocular band of yellowish brown, an

inconspicuous stripe from each antennal fossa to base of mandibles, and oral area narrowly, brown, palpi light yellow, gula light brown; scape light lemon yellow, almost stramineous, pedicel yellowish brown above, sometimes darker on sides, ring joint and flagellum light yellowish brown; dorso-cephalic corner of pronotum yellow, rest of thorax, including propodeum, black, tegulae brown; legs yellow, but all coxae black, and tarsi stramineous; stigma not densely brown; peduncle and abdomen entirely black.

Head always distinctly twice as wide as long, face almost flat, scarcely protruding beyond a straight line tangent to front edge of eyes, vertex elevated somewhat abruptly between hind ocelli, upper hind edge of head quite straight, occiput broadly concave, temples fairly prominent, hence head from above strongly rectangulate-ovate; vertex feebly umbilicate and finely and densely punctate, malar groove entire, malar space reticulate-punctate, and sparsely hairy like genae and face; pedicel slightly more than twice as long as its greatest width at apex, and one-fourth longer than F1, latter a fourth longer than thick and only slightly longer than F2, F2 to F5 subequal, F2 and F3 each a bit longer than thick, F4 and F5 scarcely longer than wide, club as long as F5, F4, and a third of F3 combined; pronotum narrower than head and mesothorax, and thorax rather coarsely umbilicate above, moderately hairy, front of mesopleura finely punctate, hind half aciculate-punctate; submarginal vein with a row of 16 to 17 setae; propodeal surface quite coarsely and variously sculptured, nearly reticulate, groove fairly deep, posterior two-thirds crossed by several subparallel rugae, the anterior third polished, and limited in front by a V-shaped carina with a rather sharply rounded apex; abdomen polished, smooth, and bare, except area of ovipositor sheath hairy and punctate.

*Male*.—Unknown.

*Type locality*.—Jacksonville, Fla.

*Type*.—Female, U.S.N.M. No. 20868.

*Remarks*.—Girault's original description was based on the type and a female paratype in the United States National Museum and collected at the type locality by W. H. Ashmead. No further facts are known about this material. In studying the National Museum specimens of this genus I have found eight additional individuals of this species that no doubt belong to the original lot taken by Ashmead but were overlooked by Girault. They bear the same locality label as the types, and agree with them in color and structural features. On one of the pins is written "*A. flocci*," which is the only hint we have concerning the host of this species. *A. flocci* is *Andricus flocci* (Walsh), which forms galls on *Quercus alba*.

It is of interest that no males are known. It is possible that some specimens of that sex belonging to this species are confused with the

mostly black males of other species, notably variety *dorsalis* of *D. querci-lanae* (Fitch). As noted heretofore, the mostly black males of several species belonging to the division of this genus without submarginal wing bands are so similar that they are not yet distinguished. This species must be reared in order to obtain males that can safely be associated with the known females.

Girault did not indicate in his privately published description of 1917 that *D. florida* is a new species. It is the first record of this species in the literature, however, and is therefore the original description. The second description, 1920, erroneously designates it as a new species. There is no question concerning the identity of the forms he had at hand on the two occasions. The locality, dates, and descriptions agree, and in each article this species is likened to Girault's *D. marylandica*, which is similar to *D. florida*.

### 37. *DECATOMA GRACILIS* Fullaway

*Decatoma gracilis* FULLAWAY, Journ. New York Ent. Soc., vol. 20, p. 280, 1912.

Described by Fullaway from the holotype male. The type was reared by Mrs. Rose Patterson Blakeman from the gall of *Andricus californicus* (Bassett) at Stanford University and is housed in the collection of that institution. It bears lot number 508, sub. 30. Dr. Isabel McCracken writes me that the type locality is St. Helena, Napa County, Calif.

I have not seen this type. Doctor McCracken kindly compared with it some specimens from my Kinsey material reared from *Andricus* galls in California, which seemed to me to fit the description. She reports that my specimens do not agree with the type. The color phase of the original description indicates strongly that the type is a specimen of an extreme dark form of male similar to variety *dorsalis* (Fitch) of *querci-lanae*. This form of male also occurs in *foliatae* Ashmead, *foliatae* var. *arizonica* Balduf, and in my species, *quinqueseptae* and *wiltzae*. Some dark males of *foliatae*, *wiltzae*, and variety *dorsalis* (Fitch) are known from *Andricus* species. They agree with *gracilis* Fullaway in being mostly black with legs mostly yellow. Much variation in the degree of yellow on the head, pronotum, and legs, as well as on the mesonotum, occurs on the series of *dorsalis* and *dorsalis*-like males at hand. The type of *D. gracilis* Fullaway is black and has only the anterior of the face, the pronotum, "except for a median V-shaped black area anteriorly," and legs, except "mid and hind femora and tibiae and hind coxae outwardly marked with black," lemon yellow. This color picture comes within the limits of color variation in my series of the mostly black males named above. Especially is the lemon yellow characteristic on this black form of male. I am unable to identify *D. gracilis* Fullaway

with certainty with any material at hand. Further rearings from the galls of *A. californicus* (Bassett) in the type locality are necessary to determine the status of Fullaway's species.

#### HOSTS OF THE SPECIES OF DECATOMA

Most of the known North American species of *Decatoma* live within galls made by Cynipidae. It is probable that they are parasitic on the larvae of the gall makers, but this relation has been demonstrated only in the case of *D. flava* Ashmead, by Triggerson. In the list below, the gall makers are cited as the hosts, but it is to be understood that the parasites may possibly develop on other insects that commonly share galls with the makers.

*Decatoma amsterdamensis* Girault has been reared from *Harmolita* spp., or joint worms. *D. nubilistigma* Walsh was obtained from a cecidomyid gall on willow, and *D. querci* Ashmead from a dipterous gall on oak. *D. flammineiventris* Girault is apparently directly parasitic on the bogus yucca moths, *Prodoxus* spp. The stem swelling on *Mimosa*, which yielded *D. mimosae* Balduf, may prove to be a cynipid gall.

#### HYMENOPTERA

##### HOST SPECIES

##### PARASITE (DECATOMA)

<i>Acraspis erinacei</i> (Beutenmueller)-----	<i>querci-lanae</i> (Fitch)
<i>macrocarpae</i> Bassett-----	<i>flava</i> Ashmead
<i>Adleria</i> sp-----	{ <i>disholcaspidis</i> Balduf
	{ <i>occidentalis</i> Balduf
<i>Amphibolips confluentus spongifica</i> (OstenSacken)-----	<i>varians</i> Walsh
<i>inanis</i> (Osten Sacken)-----	<i>varians</i> Walsh
<i>Andricus aciculatus</i> Beutenmueller-----	{ <i>querci-lanae</i> (Fitch)
	{ <i>querci-lanae dorsalis</i> (Fitch)
<i>californicus</i> (Bassett)-----	{ <i>isis</i> Girault
	{ <i>gracilis</i> Fullaway
<i>floci</i> (Walsh)-----	{ <i>florida</i> Girault
	{ <i>querci-lanae</i> (Fitch)
	{ <i>querci-lanae dorsalis</i> (Fitch)
<i>floci</i> var-----	<i>querci-lanae</i> (Fitch)
<i>floridensis</i> (Beutenmueller)-----	<i>flava</i> Ashmead
<i>foliatus</i> (Ashmead)-----	<i>foliatae</i> Ashmead
<i>lasius areolaris</i> Kinsey-----	<i>occidentalis</i> Balduf
<i>lasius lasius</i> Ashmead-----	{ <i>occidentalis</i> Balduf
	{ <i>subimmaculata</i> Girault
<i>lasius sublasius</i> Kinsey-----	{ <i>occidentalis</i> Balduf
	{ <i>subimmaculata</i> Girault
	{ <i>brevilobae</i> Balduf
<i>murtfeldiae</i> Ashmead-----	<i>flava</i> Ashmead
	{ <i>querci-lanae</i> (Fitch)

<i>Andricus pattoni</i> (Bassett)-----	<i>querci-lanae</i> (Fitch)
<i>petiolicola</i> (Bassett)-----	<i>querci-lanae</i> (Fitch)
<i>petiolicola</i> var-----	<i>querci-lanae</i> (Fitch)
<i>pomiformis</i> (Bassett)-----	<i>isis</i> Girault
<i>pomiformis maculipennis</i> (Kieffer)-----	<i>subimmaculata</i> Girault
<i>pomiformis rossi</i> (Kieffer)-----	<i>pomiformis</i> Balduf
<i>quinqueseptum</i> var-----	<i>flava</i> Ashmead
<i>spectabilis</i> Kinsey-----	<i>isis</i> Girault
	<i>subimmaculata</i> Girault
<i>suttoni</i> (Bassett)-----	<i>isis</i> Girault
<i>tecturnarum</i> Kinsey-----	<i>globuli</i> Balduf
<i>tubularius</i> Weld-----	<i>flava</i> Ashmead
<i>turnerii</i> (Ashmead)-----	<i>lanae</i> Ashmead
<i>wiltzae</i> Fullaway-----	<i>lobatae</i> Balduf
	<i>wiltzae</i> Balduf
<i>sp</i> -----	<i>occidentalis</i> Balduf
<i>Belonocnema fossoria</i> Weld-----	<i>dubia</i> Walsh
	<i>dubia rufosa</i> Balduf
<i>Biorhiza caepuliformis</i> (Beutenmueller)-----	<i>varians</i> Walsh
	<i>globuli</i> Balduf
<i>forticornis</i> (Walsh)-----	<i>nigriceps</i> Walsh
	<i>querci-lanae</i> (Fitch)
<i>Callirhytis cornigera</i> (Osten Sacken)-----	<i>novascotiae</i> Balduf
	<i>brevilobae</i> Balduf
<i>flavipes</i> (Gillette)-----	<i>foliatae</i> Ashmead
	<i>querci-lanae</i> (Fitch)
<i>gemmaria</i> (Ashmead)-----	<i>varians</i> Walsh
	<i>disholcaspidis</i> Balduf
<i>ruginosus</i> (Bassett)-----	<i>foliatae arizonica</i> Balduf
	<i>globuli</i> Balduf
	<i>occidentalis</i> Balduf
<i>sottula</i> (Bassett)-----	<i>querci-lanae</i> (Fitch)
	<i>flava</i> Ashmead
<i>seminator</i> (Harris)-----	<i>querci-lanae</i> (Fitch)
<i>tubicola</i> (Osten Sacken)-----	<i>flava</i> Ashmead
	<i>querci-lanae</i> (Fitch)
<i>tumifica</i> (Osten Sacken)-----	<i>querci-lanae dorsalis</i> (Fitch)
<i>sp</i> -----	<i>querci-lanae</i> (Fitch)
<i>sp</i> -----	<i>subimmaculata</i> Girault
<i>sp</i> -----	<i>varians</i> Walsh
<i>Compsodryoxenus humilis</i> Weld-----	<i>flava</i> Ashmead
	<i>flava</i> Ashmead
<i>Cynips pezomachoides</i> Osten Sacken-----	<i>pezomachoides</i> Balduf
	<i>querci-lanae</i> (Fitch)
<i>pezomachoides crinacci</i> (Mayr)-----	<i>flava</i> Ashmead
<i>weldi</i> var-----	<i>occidentalis</i> Balduf
<i>sp</i> -----	<i>querci-lanae</i> (Fitch)
<i>Diptolepis echina</i> Osten Sacken-----	<i>occidentalis</i> Balduf
<i>Disholcaspis corallina</i> (Bassett)-----	<i>dubia doanei</i> Fullaway
	<i>occidentalis</i> Balduf
<i>chrysolepidis</i> Beutenmueller-----	<i>dubia doanei</i> Fullaway
<i>cinerosa</i> (Bassett)-----	<i>disholcaspidis</i> Balduf

<i>Disholcaspis corallina</i> (Bassett)-----	{ <i>dubia doanei</i> Fullaway <i>occidentalis</i> Balduf
<i>eldoradensis</i> (Beutenmueller)-----	{ <i>dubia doanei</i> Fullaway <i>varians</i> Walsh
<i>eldoradensis</i> var-----	{ <i>dubia doanei</i> Fullaway <i>globuli</i> Balduf
<i>fasciata</i> Bassett-----	{ <i>dubia</i> Walsh <i>foliatae</i> Ashmead <i>varians</i> Walsh
	{ <i>dubia</i> Walsh <i>dubia rufosa</i> Balduf <i>flava</i> Ashmead
<i>globulus</i> (Fitch)-----	{ <i>foliatae</i> Ashmead <i>globuli</i> Balduf <i>querci-lanae</i> (Fitch) <i>querci-lanae dorsalis</i> (Fitch)
	{ <i>dubia</i> Walsh <i>nigriceps</i> Walsh
<i>mamma</i> (Walsh)-----	{ <i>querci-lanae</i> (Fitch) <i>querci-lanae dorsalis</i> (Fitch)
<i>mamma</i> var-----	<i>dubia rufosa</i> Balduf
<i>plumbella</i> Kinsey-----	<i>dubia doanei</i> Fullaway
	{ <i>dubia</i> Walsh <i>dubia rufosa</i> Balduf <i>globuli</i> Balduf
<i>spongiosa</i> Karsch-----	{ <i>occidentalis</i> Balduf <i>subimmaculata</i> Girault
<i>truckeensis</i> (Ashmead)-----	<i>disholcaspidis</i> Balduf
sp-----	<i>flava</i> Ashmead
sp-----	<i>globuli</i> Balduf
sp-----	<i>globuli</i> Balduf
sp-----	<i>varians</i> Walsh
<i>Dryorhizoxenus floridanus</i> Ashmead-----	<i>bicolor</i> Ashmead
<i>Harmolita hordei</i> (Harris)-----	<i>amsterdamensis</i> Girault
sp-----	<i>amsterdamensis</i> Girault
<i>Hemadis nubilipennis</i> Ashmead-----	<i>vacciniicola</i> Balduf
<i>Heteroecus dasydactyli</i> (Ashmead), or <i>H. melanoderma</i> Kinsey.	<i>subimmaculata</i> Girault
<i>pacificus</i> (Ashmead)-----	<i>subimmaculata</i> Girault
<i>pacificus pacificus</i> (Ashmead)-----	<i>subimmaculata</i> Girault
sp-----	<i>subimmaculata</i> Girault
	{ <i>flava</i> Ashmead <i>marylandica</i> Girault <i>novascotiae</i> Balduf <i>querci-lanae</i> (Fitch)
<i>Neuroterus batatus</i> (Fitch)-----	<i>flava</i> Ashmead
<i>batatus noxiosus</i> form <i>noxiosus</i> (Bassett)---	<i>querci-lanae</i> (Fitch)
<i>majalis</i> (Bassett)-----	<i>querci-lanae dorsalis</i> (Fitch)
	<i>flava</i> Ashmead
<i>noxiosus</i> (Bassett)-----	<i>querci-lanae dorsalis</i> (Fitch)
<i>quercicola pacificus varians</i> Kinsey-----	<i>lobatae</i> Balduf
<i>saltatorius</i> (Edwards)-----	<i>querci-lanae</i> (Fitch)

<i>Plagiotrochus batatoides</i> (Ashmead)-----	<i>foliatae</i> Ashmead
<i>chrysolepidicola</i> (Ashmead)-----	{ <i>isis</i> Girault <i>occidentalis</i> Balduf
<i>chrysolepidicola pugnus</i> Kinsey-----	
<i>coxi</i> (Bassett)-----	<i>varians</i> Walsh
<i>frequens frequens</i> (Gillette)-----	<i>flavipes</i> Balduf
<i>punctatus</i> (Bassett)-----	<i>varians</i> Walsh
<i>quinqueseptum</i> var-----	<i>quinqueseptae</i> Balduf
<i>tumifica</i> (Osten Sacken)-----	<i>nigriceps</i> Walsh

## MISCELLANEOUS

Dipterous gall on <i>Quercus laevis</i> Walter ( <i>cates-</i> <i>baci</i> Michaux).	<i>querci</i> Ashmead
<i>Prodoxus quinquepunctellus</i> Chambers-----	<i>flamminneiventris</i> Girault
<i>y-inversus</i> Riley-----	<i>flamminneiventris</i> Girault
<i>Rhabdophaga batatae</i> (Walsh)-----	<i>nubilistigma</i> Walsh
Stem gall on <i>Mimosa biuncifera</i> -----	<i>mimosae</i> Balduf

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#### EXPLANATION OF PLATES

The photographs of the wings on Plates 1 and 2 were made by A. D. Eldredge, formerly in charge of photography at the University of Illinois, and the drawings by Mrs. W. V. Balduf. The photographed wings are all to the same scale, and the drawings of Plates 3 and 4 vary slightly in the rate of magnification.

#### PLATE 1

- Figure 1. *Decatoma vacciniicola*, new species. Right front wing.  
2. *Decatoma flava* Ashmead. Right front wing.  
3. *Decatoma lanae* Ashmead. Right front wing.  
4. *Decatoma amsterdamensis* Girault. Left front wing.  
5. *Decatoma texana*, new species. Right front wing.  
6. *Decatoma disholcaspidis*, new species. Left front wing.  
7. *Decatoma nubilistigma* Walsh. Left front wing.  
8. *Decatoma bicolor* Ashmead. Left front wing.  
9. *Decatoma isis* Girault. Right front wing.  
10. *Decatoma varians* Walsh. Right front wing. California.  
11. *Decatoma varians* Walsh. Left front wing. Illinois.  
12. *Decatoma dubia* Walsh. Right front wing.  
13. *Decatoma dubia rufosa*, new variety. Right front wing.

#### PLATE 2

- Figure 14. *Decatoma dubia doanei* Fullaway. Left front wing.  
15. *Decatoma lobatae*, new species. Right front wing.  
16. *Decatoma globuli*, new species. Right front wing.  
17. *Decatoma novascotiae*, new species. Left front wing.  
18. *Decatoma flamminneiventris* Girault. Right front wing.  
19. *Decatoma occidentalis*, new species. Left front wing. Arizona.  
20. *Decatoma occidentalis*, new species. Right front wing. California.  
21. *Decatoma brevilobae*, new species. Left front wing.  
22. *Decatoma nigriceps* Walsh. Right front wing.  
23. *Decatoma foliatae arizonica*, new variety. Left front wing.  
24. *Decatoma pomiformis*, new species. Left front wing.  
25. *Decatoma marylandica* Girault. Left front wing.  
26. *Decatoma querci-lanae* (Fitch). Right front wing.

## PLATE 3

Figure 27. *Decatoma flamminneiventris* Girault. Pronotum, male.

28. *Decatoma flamminneiventris* Girault. Umbilicate punctures of scutel, greatly enlarged.

29. *Decatoma flamminneiventris* Girault. Mesonotum, male. *a*, Pre-scutum; *b*, *b*, scapulae; *c*, *c*, axillae; *d*, scutel.

30. *Decatoma vacciniicola*, new species. Male antenna. Sensoria.

31. *Decatoma vacciniicola*, new species. Female antenna. Sensoria.

32. *Decatoma lanae* Ashmead. Female antenna.

33. *Decatoma vacciniicola*, new species. Front wing; *a*, submarginal vein; *b*, marginal vein; *c*, postmarginal vein; *d*, stigmal vein; *e*, submarginal band; *f*, cubital row; *g*, subdiscoidal row.

34. *Decatoma disholcaspidis*, new species. Front wing.

## PLATE 4

Figure 35. *Decatoma vacciniicola*, new species. Female propodeum. Dorsal view.

36. *Decatoma vacciniicola*, new species. Male propodeum. Dorsal view.

37. *Decatoma flamminneiventris* Girault. Female propodeum. Dorsal view.

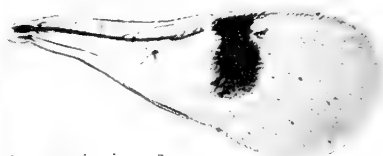
38. *Decatoma lanae* Ashmead. Female propodeum. Dorsal view.

39. *Decatoma flava* Ashmead. Female propodeum. Dorsal view.

40. *Decatoma vacciniicola*, new species. Female. Front view of head. Antennae removed.

41. *Decatoma flamminneiventris* Girault. Male. Head, dorsal view.

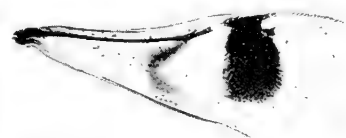
42. *Decatoma flava* Ashmead. Male. Head, dorsal view.



1 *vacciniticola*



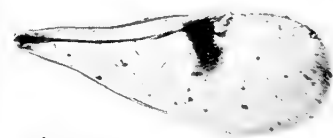
8 *bicolor*



2 *flava*



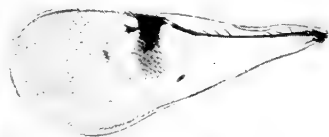
9 *isis*



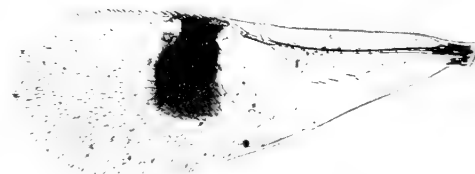
3 *lanae*



10 *varians*



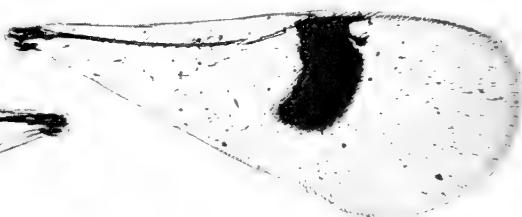
4 *amsterdamensis*



11 *varians*



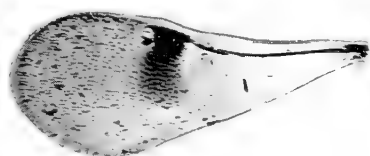
5 *texana*



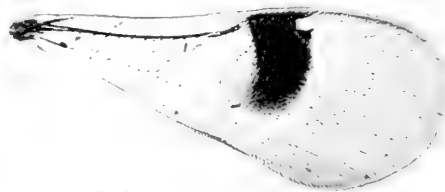
12 *dubia*



6 *disholcaspidis*



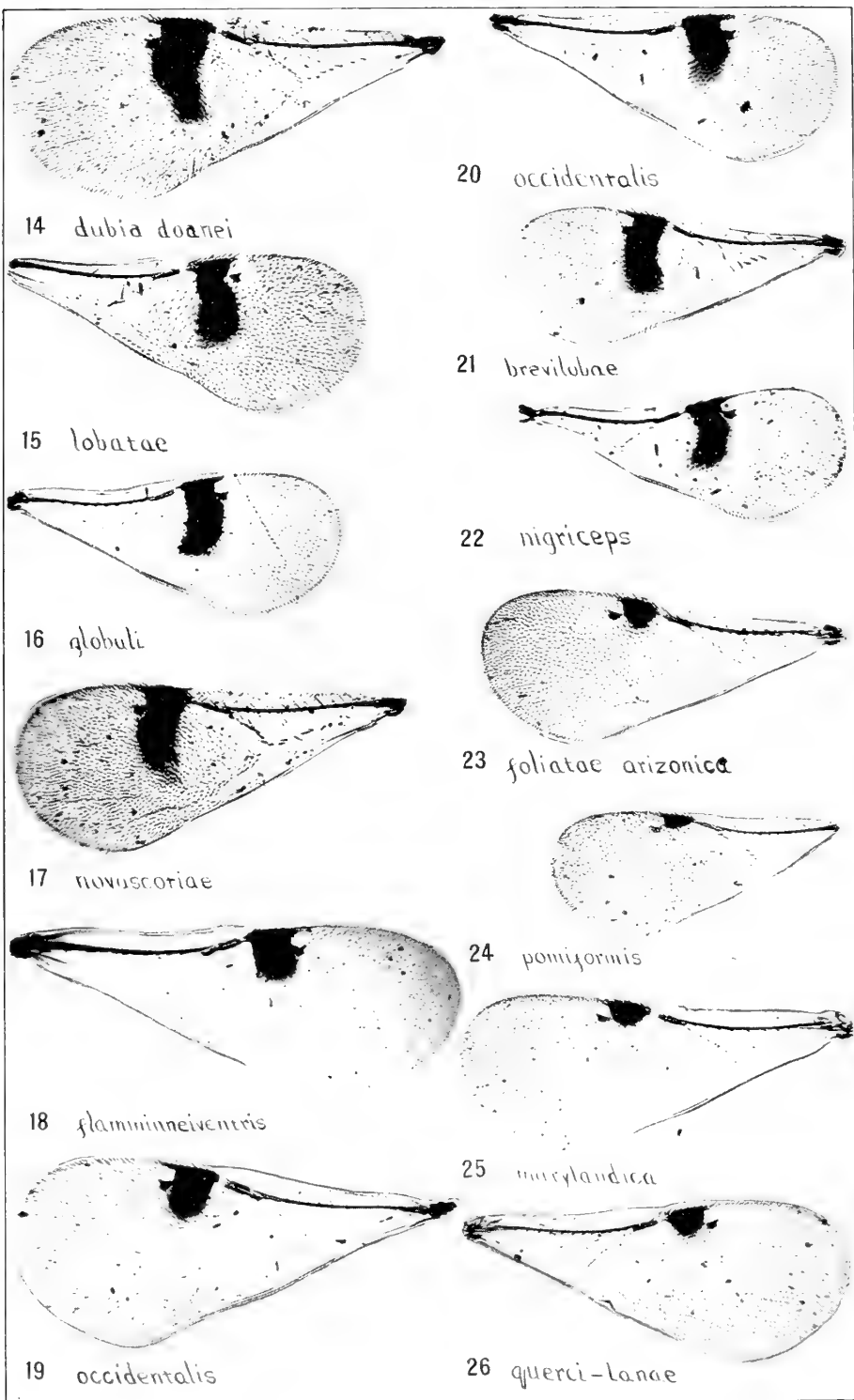
7 *nubilistigma*



13 *dubia rufosa*

WINGS OF VARIOUS SPECIES OF DECATOMA

FOR EXPLANATION OF PLATE SEE PAGE 93.

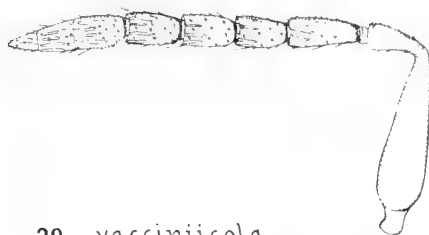


WINGS OF VARIOUS SPECIES OF DECATOMA

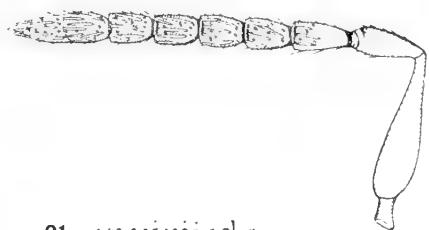
FOR EXPLANATION OF PLATE SEE PAGE 93



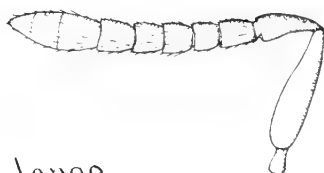
27 *flamminiveutris*



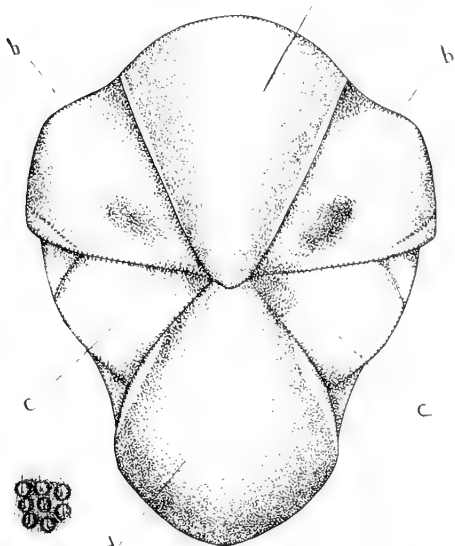
30 *vacciniicola*



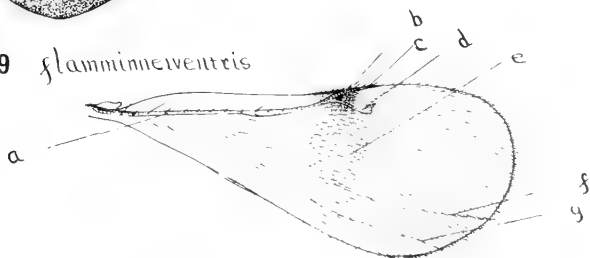
31 *vacciniicola*



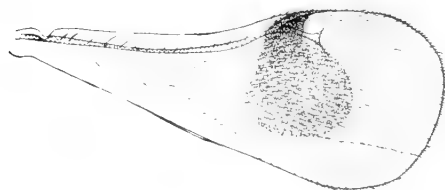
32 *lanae*



28 & 29 *flamminiveutris*



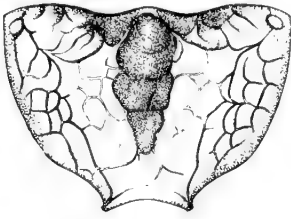
33 *vacciniicola*



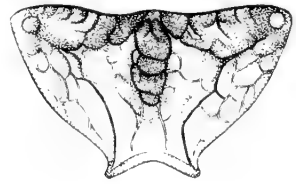
34 *disholcaspidis*

PARTS OF VARIOUS SPECIES OF DECATOMA

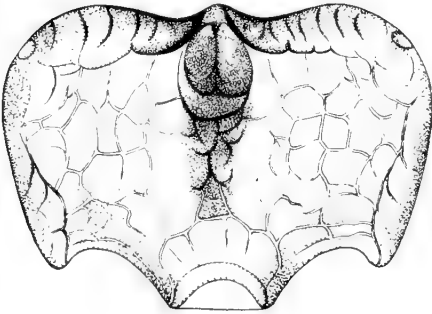
FOR EXPLANATION OF PLATE SEE PAGE 94.



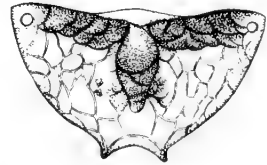
35 *vacciniicola*



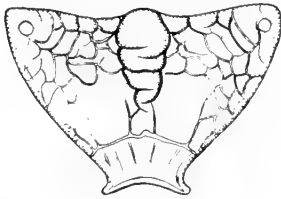
36 *vacciniicola*



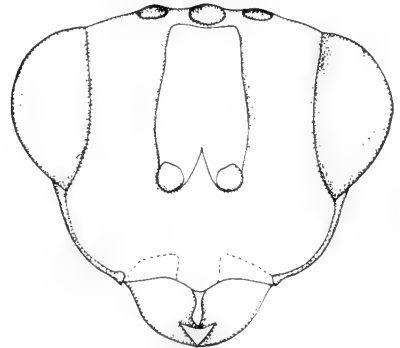
37 *glamminneiventris*



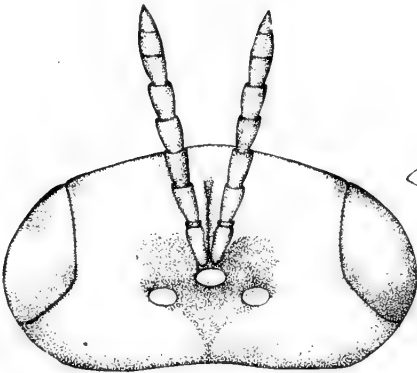
38 *lanae*



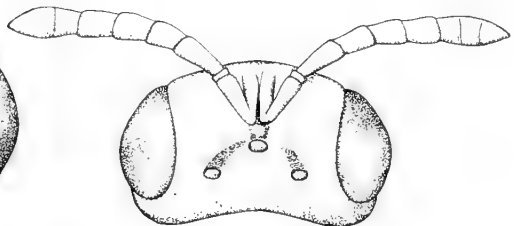
39 *flava*



40 *vacciniicola*



41 *glamminneiventris*



42 *flava*

## INDEX

(Principal references are given in bold-face figures, synonyms in italics. See page 89 for list of hosts of the species of *Decatoma*)

- Decatoma* Spinola, 4, 7, 19, 28, 29, 60, 82.  
*amsterdamensis* Girault, 9, 20.  
*arizonica*, new variety of *foliatae*, 10, 11, 77, 82, 88.  
*autumnalis* Girault, 66, 67.  
*batatoides* Ashmead, 79, 82.  
*bicolor* Ashmead, 8, 29.  
*brevilobae*, new species, 10, 45, 56.  
*catesbaei* Ashmead, 14, 16.  
*compressa* Girault, 66, 67.  
*disholcaspidis*, new species, 8, 23, 25, 55.  
*doanei* Fullaway, variety of *dubia*, 10, 39, 43, 45.  
*dorsalis* (Fitch), variety of *quercilanae*, 10, 74, 76, 77, 79, 81, 82, 88.  
*dubia* Walsh, 2, 10, 30, 32, 33, 38, 39, 41, 42, 43, 45, 49, 50, 54, 65.  
*dubia* variety *doanei* Fullaway, 10, 39, 43, 45.  
*dubia* *rufosa*, new variety, 10, 41, 43, 49.  
*excrucians* Walsh, variety of *nigriceps*, 66.  
*flamminneiventris* Girault, 7, 10, 23, 52, 53, 54, 55.  
*flava* Ashmead, 8, 12, 14, 18, 20, 22, 23, 25, 26, 30.  
*flavicollis* Ashmead, 72, 74.  
*flavicollis* Walker, 72, 74.  
*flavifrons*, new variety of *occidentalis*, 9, 61.  
*flavipes*, new species, 10, 52, 53.  
*florida* Girault, 10, 11, 60, 61, 85, 86, 88.  
*floridana* J. B. Smith, 72, 74.  
*foliatae* Ashmead, 10, 11, 72, 77, 78, 79, 81, 82, 83, 88.  
*foliatae arizonica*, new variety, 10, 11, 77, 82, 88.  
*globuli*, new species, 2, 9, 10, 47, 49, 50, 65.  
*gracilis* Fullaway, 88.  
*hyalipennis* Walsh, 72, 74.  
*isis* Girault, 9, 30, 32.  
*kelloggi* Fullaway, 33, 37.  
*lanae* Ashmead, 9, 19, 29.  
*lobatae*, new species, 10, 45.  
*marylandica* Girault, 10, 11, 83, 85, 86, 88.  
*Decatoma michiganica* Girault, 72, 74.  
*mimosae*, new species, 8, 25.  
*nigriceps* Walsh, 2, 8, 9, 50, 58, 62, 65, 66.  
*nigriceps* var. *excrucians* Walsh, 66.  
*nubilistigma* Ashmead, 12.  
*nubilistigma* Walsh, 9, 12, 13, 26, 29.  
*novascotiae*, new species, 10, 47, 50, 52.  
*occidentalis*, new species, 9, 58, 60, 61, 62.  
*occidentalis flavifrons*, new variety, 9, 61.  
*pezomachoides*, new species, 11, 69.  
*phellos* Ashmead, 33.  
*pomiformis*, new species, 12, 70.  
*querci* Ashmead, 18.  
*querci-lana-dorsalis* (Fitch), 76.  
*querci-lanae* Ashmead, 72, 76.  
*querci-lanae* (Fitch), 12, 66, 72, 74, 75, 76, 77, 79, 81.  
*querci-lanae* var. *dorsalis* (Fitch), 10, 74, 76, 77, 79, 81, 82, 88.  
*quinqueseptae*, new species, 10, 11, 77, 78, 88.  
*rufosa*, new variety of *dubia*, 10, 41, 43, 45, 49.  
*simplicistigma* Walsh, 72, 74.  
*subimmaculata* Girault, 12, 66, 67, 68, 69, 70.  
*texana*, new species, 8, 22.  
*vaccinicola*, new species, 8, 12, 14, 15, 19.  
*varians* Provancher, 12.  
*varians* Walsh, 9, 12, 13, 30, 32, 33, 35, 37, 38, 49, 56.  
*wiltzae*, new species, 10, 11, 77, 83, 85, 88.  
*Decatomini*, 1, 2, 3, 4.  
*Eudecatoma* Ashmead, 4, 61.  
*batatoides* Ashmead, 79.  
*Eurytoma* Illiger, 1.  
*Eurytomidae*, 3.  
*Eurytomini*, 2, 4.  
*Harmolita*, 1, 21.  
*Isosoma*, 21.  
*hordei*, 21.  
*Spalangia querci-lanae* Fitch, 72.  
*querci-lanae* var. *dorsalis* Fitch, 76.





## THE BUFFALO MOTIVE IN MIDDLE CELEBES DECORATIVE DESIGN

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By WALTER HOUGH

*Head Curator of Anthropology, United States National Museum*

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An acquaintance with middle Celebes design was derived from a study of a collection brought from that island in 1916 by H. C. Raven, explorer, and presented to the United States National Museum by Dr. W. L. Abbott. The collection is a general one illustrative of the material culture of the Malay groups on the middle Celebes, thoroughly labeled, and from its diversity and completeness reflecting great credit on the collector.

Especially interesting are the varied examples of bark cloth, differing in quality and character according to the uses to which they were put. Most of the bark-cloth specimens are costume or adjuncts of costume. There are, therefore, no great sheets of bark cloth as observed in the tapa of the Pacific islanders manufactured by pasting strips of the beaten bark together. The middle Celebes cloths are apparently a primitive type beaten out from a single strip of bark, thus forming pieces useful for turbans, loin cloths, and the like.

It was seen at once that the decorated cloth, principally jackets and turban strips, bore designs new to the Museum and of unique character not related to any art hitherto observed in Malaysia.

The contents of the designs are three elements or units, as circles, diamonds, and pairs of crescentic figures diverging outwardly from a base. These elements used in conjunction, sometimes in a definite order and again as units of design reaching the geometric, as suited the artist's fancy, formed an interesting problem. Based on a knowledge of Pueblo Indian designs, it was more than suspected that the Celebes designs were zoomorphic.

In studying other specimens in the collection this supposition became a certainty. Several hooks of horn and wood used for hanging articles in the house afforded the clue and themselves illustrated grades from the conventional to the realistic or vice versa, no assertions as to the order being stated. It will be seen that the realistic specimen represents a female figure standing between the horns of a buffalo (pl. 1, fig. 3). Another hook (pl. 1, fig. 5) shows a more

conventional treatment, a third (pl. 1, fig. 6) still more, while a fourth is quite conventional (pl. 1, fig. 2). Horn spoons (pl. 1, figs. 1 and 4) are still more conventional. It became evident that the makers of the hooks used the same design displayed in the bark-cloth decorations. On the bark cloth none of the designs is realistic, the difference between sculptural and decorative treatment being easily determined. It is suggested that the relationship between sculptural and decorative designs is not close, and this is due to the fact that they are radically different in their beginnings.

The hooks also revealed several other interesting developments. The buffalo, on information of Dr. Gerrit S. Miller, jr., is the Indian *Bos Gaur* introduced into the Celebes art at some unknown time and not the small animal anoa with slightly curved horns native to that island. Another extremely interesting feature of the hooks is the female figure between the horns of the bull, which can be identified in Hindu mythology as Durga, the consort of Siva. There is evidently here the fact of the introduction of the Indian buffalo and the Siva cult and also the bringing of a particular art based on these motives.

As stated, it is not possible now to assign a date to this introduction. The development of the buffalo designs, which has proceeded rather far, has little bearing on the time necessary for its evolution, for the reason that a style may proceed to fruition at times quite rapidly and assume an indigenous aspect.

The exclusive use of the buffalo designs in this area of the Celebes brings up the question as to whether they displaced previous nature designs. In answer it can only be said that there is no mixture with the buffalo design and no traces of an anterior decorative art can be discerned in the ethnological collection made by Mr. Raven, none of which, except some parangs, are old. It would be expected that etching on cane tubes, widespread in the Pacific, would tend to preserve traces of older art, but specimens in the collection show only buffalo motives. (Pls. 8, 9.)

There remains the supposition that the middle Celebes tribes had no indigenous decorative art at the time of the introduction of the Indian buffalo. This is worthy of consideration when the paucity of Malay decorative art is observed. The great collections of Dr. W. L. Abbott in the United States National Museum from the Philippines and other collections from the Malay area are singularly limited in the use of color and decorative design. The collections present a monotony of the natural color of materials. From this circumstance they present a primitive aspect. Nevertheless, if the Celebes people could take up and develop a new decorative art like the buffalo designs, there is every reason to believe that they had a basal art of their own, but probably quite limited in content.

## DESIGN

The proliferation of Celebes buffalo designs was facilitated by the presence of a suitable, receptive, and prevalent medium for placing and elaborating decorations. From these considerations the florescence of the introduced buffalo designs would be assured. No doubt the presence or absence of media or fields for decoration has profoundly affected the progress of decorative art in all stages of man's art history.

Decorations of the Celebes bark cloth medium offered to the artist all the interesting problems observed by the transmutation of designs enforced by the areas to be covered, broader fields taking bolder designs made up of complete figures, smaller fields, units or fragments for bordering bands, and limited areas.

Keeping in mind the process followed in the disintegration of designs in which presence and coherence of all the elements in juxtaposition is necessary at the beginning, we can trace the dissolution from the complex to the simple designs. The complex designs drawn on broad areas are not and never have been realistic like the carved hooks. They were put on the surface under rigid limitations belonging to decorative art, and only when there has been a high development do realistic drawings appear, and then are not connected with useful decorations but are a distinct branch of art.

The presence in the water-buffalo design of several elements capable of producing variety is especially noticeable. These are the eye, the curved horns, the ears, the standing figure, the forehead mark or diamond, which form the grammar of the designs. It is seen that the elements are not harmonious in the larger designs on account of the admixture of curvilinear and geometric elements in one design. This is especially seen in the cases where the horns remain in pairs with no terminus to the curves. Harmony is gained when geometrics reach ascendancy in the border patterns.

The complete buffalo designs were segmented by the Celebes artist into several decorative units, all freely used in the various sequences. It is evident that the art had not progressed to the state where a surviving element, for instance the eye, only remains as a clew to the zoomorphic origin of the designs. The segments used are the horns in pairs and singly; the eyes; the ears; the diamond figure placed in the area between the eyes and base of the bull's horns, apparently a sex symbol. The female figure seems to have suffered most from transmutation. Smaller adjuncts not clearly traceable to the key designs shown in the hooks are bands of solid color, hachuring, and series of short lines to diversify white areas.

With these elements the Celebes artists produced unified results, indicating what may be termed a school of design. A singular fact

in the progress of this school is that the artists did not discover or use interlocking running designs which the curving horns would patently suggest. The horns are freely used separately, as in the borders in Plate 2, *a* and *b*. The eyes have a tendency to be placed in pairs, as in Plate 2, *b*, and other plates. The diamond figure is used entire, separated into two triangles (pl. 4, *b*) or quartered (middle band in pl. 4, *a*). Hachured diamonds are seen in Plates 2, *a*, and 4, *b*.

In some cases a purer decoration is applied over the whole surface, as in Plate 3, *b*, which has a symmetrical 4-part design repeated on a background spotted with numerous eye circles. This specimen shows more freedom and simplicity in handling the design and also considerable taste in the use of color. The design in Plate 3, *a*, is in contrast and would appear to be only a slight departure from realism.

The figures in Plate 4, *a*, are disposed in panels and bandings. The designs are in four and the horn pairs arise from the base of the triangular half diamond. A cross figure like a flower and a commalike figure, apparently a stalked eye, are placed to produce variety and balance. A broader treatment is seen in Plate 4, *b*, where horns and eyes are combined into a treelike figure drawn in a triangular area and interspersed with similar alternating areas of bands and triangles.

Plate 5 shows almost the only circular design, also in four parts, with wedges at the axis forming a 4-point star.

Panel designs seem to be the most favored by the Celebes decorators, as seen in Plate 6, *a*, where a complete buffalo convention is surrounded by a border of horns and hachured diamonds and diamonds divided into four sections by two cross lines. The group of bars in the middle band appear as an addition to the customary units of design mentioned. Very few designs indicating motion are found in Celebes decorative art. One design whose axis is the St. Andrews cross is given the motion idea by four curving horns turning to the right (pl. 6, *b*). Apparently motion is indicated in a diagonal cross pattern shown on Plate 7, *a*. Examples of geometric border designs are shown on Plate 7, *b*, and varieties of these conventions may be seen on other illustrations (see pls. 2, *a*, and 4, *a*).

Gourd containers of bottle shape and bamboo or coconut boxes and flutes are well represented in the collection. Ordinarily such objects are prevalent over a vast area in Malaysia and the Pacific islands and are examples usually of the best and most accurate art of decoration. Gourd and bamboo containers shown on Plate 8 give examples of buffalo design executed with meticulous care. Espe-

cially instructive are the bands and panels of all-over geometric designs met with in many places over the region mentioned but which in this case are believed to be derived from the buffalo motives (pls. 8 and 9). Attention is called to the openwork projections at the ends of a weaving frame which shows the buffalo design at its highest excellence (pl. 9).

#### BARK CLOTH IN THE CELEBES

Bark cloth is quite generally used in the Celebes. It is made by the simple tools and processes accompanying the art wherever it is prosecuted. Naturally the art is of varying competency in different parts of its area of distribution. The contrast between the bark cloth of Africa, Malaysia, and Polynesia is very great. That of Africa is crudest, of Malaysia intermediate, and of Polynesia best. There is evident connection of Malay bark cloth with that of Polynesia and it is possible that bark-cloth making in Africa is remotely derived from East Indian sources.

Bark cloth seems to have an ancient and wide distribution in tropical and subtropical lands. The range of the art is seen to be limited by the distribution of forest elements having interlacing bark filaments capable of being softened and expanded by the universal process of beating practiced in the range of the bark-cloth art.

The tools necessary in the making of bark cloth are simple, but are the result of a knowledge that the expansion of the bark into cloth is facilitated by an implement having a succession of ridges on its surface. It was found that the ridged tool was essential to success in working the bark. This tool is therefore found wherever bark cloth is made.

In the zones of the New World where the bark of proper texture occurs grooved beaters are found. So far as they have survived only stone-age tools for bark beating are found in America as in Mexico, but wooden beaters may have been used. Ethnological specimens in the Abbott collections indicate that in Malaysia and in the islands off the coast of New Guinea stone beaters hafted in thong handles were the rule, but wooden grooved clubs were also used. In the Celebes the wooden clubs were required for softening the bark, which was then finished with the stone tools. Generally these are oblong-ovate slabs of stone grooved on one or both sides, or pestle shape as in some of the Papuan islands mentioned above. The Celebes form is a pounder of wood and stone (U.S.N.M. No. 301345, from Koelawi).

The material of which bark cloth is made in the Celebes has not been botanically identified. The bark used at Koelawi is from the

*warimgau* tree, possibly a *ficus*. It appears from the specimens of cloth from different localities that several species of trees furnish bark, as some of the cloth is coarse and some quite fine; none, however, having the softness of Samoan or especially Fijian tapa. The refinements observed in Polynesian bark cloth are not found in the more primitive examples of Malaysia. The Malays have not discovered or perhaps needed the method of increasing the size of the cloth by pasting strips together as in Polynesia, where sometimes immense pieces are made in this way. The Malay economy did not require spreads or partitions or costumes of this material. Curiously, in the Congo tapa is joined by sewing together pieces of regular size as in our familiar patchwork quilts.

Some patterned tapa beaters are seen in the Celebes, but not of the fineness of those found in Polynesia, where the refinement of club pattern marks in the texture of the cloth is carried to a high point. The pattern marks resemble watermarks in paper and are likewise generally seen only by holding the fabric up to the light. Another refinement in Polynesia is seen in the perfuming of tapa cloths.

No decorating devices are seen in Malaysia as the Samoan printing blocks or the Fijian carved bamboo strips. The decoration of Celebes and other Malay tapas is simply done free-hand with sticks dipped in color. No continuous border lines appear. In most cases the designs are painted on the tapa as individual units, that is, sprigged as in Hindu muslins, and with no intent to produce an all-over decoration as in most Polynesian tapas.

The Celebes decorated bark cloth shows a limited range of color, soft red, yellow brown, and black being used. These are evidently vegetal colors derived from the plant environment. Aniline colors have found their way here and especially at Bada Toare are the foreign dyes seen. As a rule the colors are semiskillfully laid on. In some instances the drawing is rather good. In general, while the water-buffalo art has found itself in design, the execution has lagged. It does not compare with the sure and intricate art of Borneo, and this is a point bearing on whether the Celebes art discussed here shows traces of a comparatively recent origin. It has been stated that a large number of the specimens of bark cloth collected by Mr. Raven are for winding about the head; that is, turbans. This form of headdress which, so far as the writer is informed, has not been studied, is undoubtedly ancient. Its extension from its presumed points of origin in the Near East appears to be due to the Mohammedan conquest. The causation origin of the turban would be protection from a fierce sun. It is possible, then, that the Malay turban would come into use in this remote region some time after the ninth

century, though there is no data for this assumption. The turban in India could be assigned to the period of the Mogul invasion, but communication from the west occurred during ancient times.

Bark-cloth sarongs also prevail, often elaborately decorated. Jackets of bark cloth worn by women show skill in native tailoring and have some of the best examples of water-buffalo designs.

The localities from which bark cloth was collected by Dr. Raven are either political divisions or towns in central Celebes south of the Gulf of Tomini. They are Koelawi, Wiratoe, Piana, Tomado Lindoe, Bada Toare, and Jimpoa, located on the excellent Dutch map of the Celebes. Differences are observed in the cloth from these localities. Koelawi produces both coarse and fine cloth, as does Wiratoe. Piana makes plain cloth for coarser clothing, and from Tomado Lindoe and Bada Toare come the best examples of decorated specimens.

#### BARK CLOTH IN COSTUMES OF MIDDLE CELEBES

The extent to which bark cloth enters into the costume of the natives and the variety of the parts of costume worn is surprising. Most of the pieces of dress and the adjuncts of dress are of bark cloth. Formerly the exclusive use of bark cloth was the rule, but in the accelerating changes introduced from the outside in recent years other materials have appeared.

Cotton cloth especially has superseded the primitive bark cloth, dyed cloth of foreign origin. This has affected the traditional uses of bark cloth. Thus jackets, skirts, and headbands are now often lined with cotton and cotton is applied in various ways to bark-cloth garments. The people of the middle Celebes generally practice tailoring; in fact, in this grade are expert tailors. In this respect they are far beyond the Polynesians who wear primitive dress.

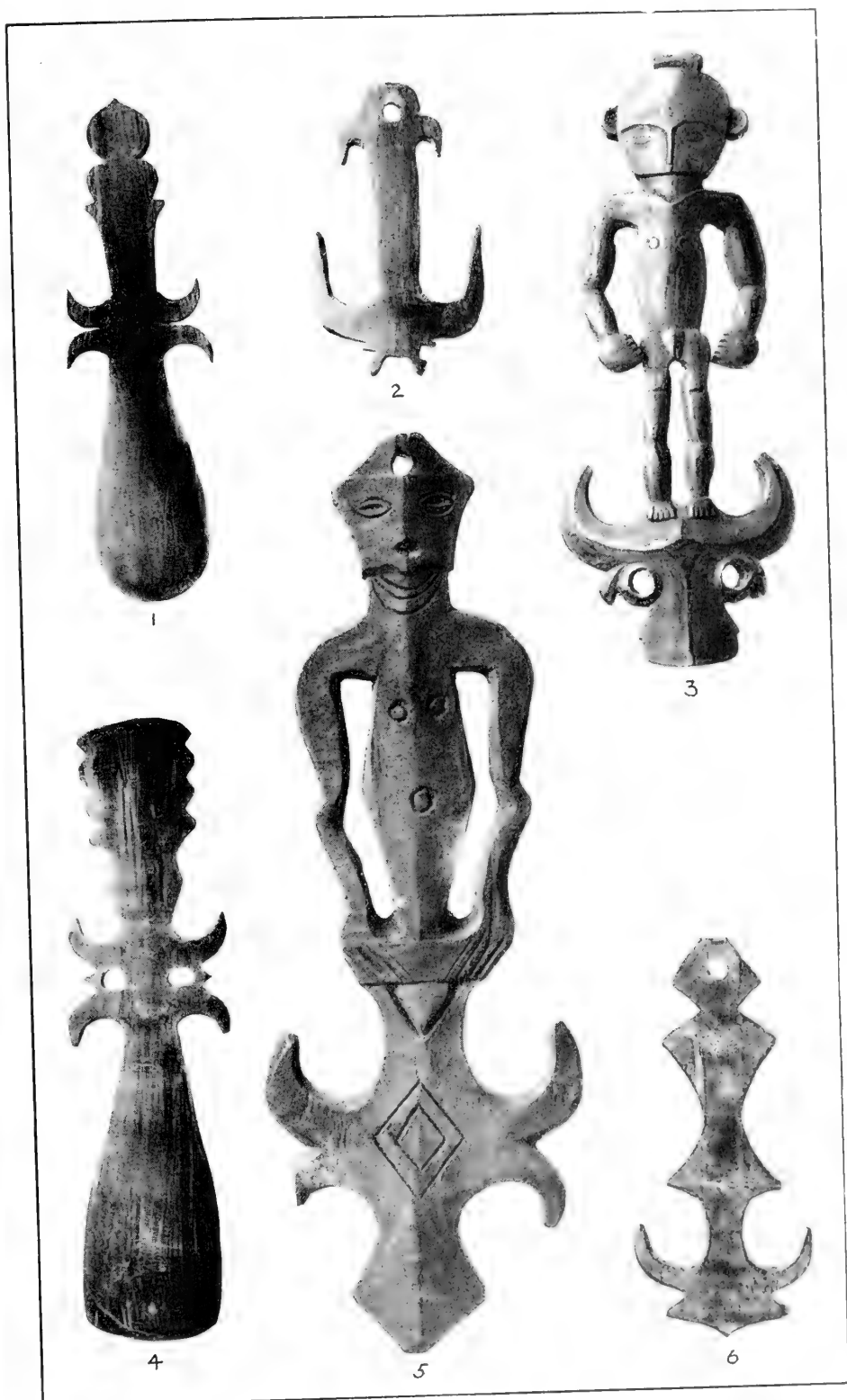
The costume of the middle Celebes tribes must be divided into utilitarian and special—that is, the clothing when at work and that on gala or other occasions. Social or official standing also present some modifications of dress.

Men wear on the head a turban consisting of a square of bark cloth decorated and folded so as to encircle or cover the head with points projecting at the sides. A sleeveless tailored jacket covers the trunk, and a sarong or waist cloth of bark is wound about the loins. No foot covering is worn. Men carry attached to the loin cloth a squatting mat cut from anoa buffalo skin or woven of palm strips. The above, omitting the jacket, describes the man's work costume. He would also carry a pouch or pouches for small articles and a work parang. War parangs have long been obsolete in the middle Celebes.

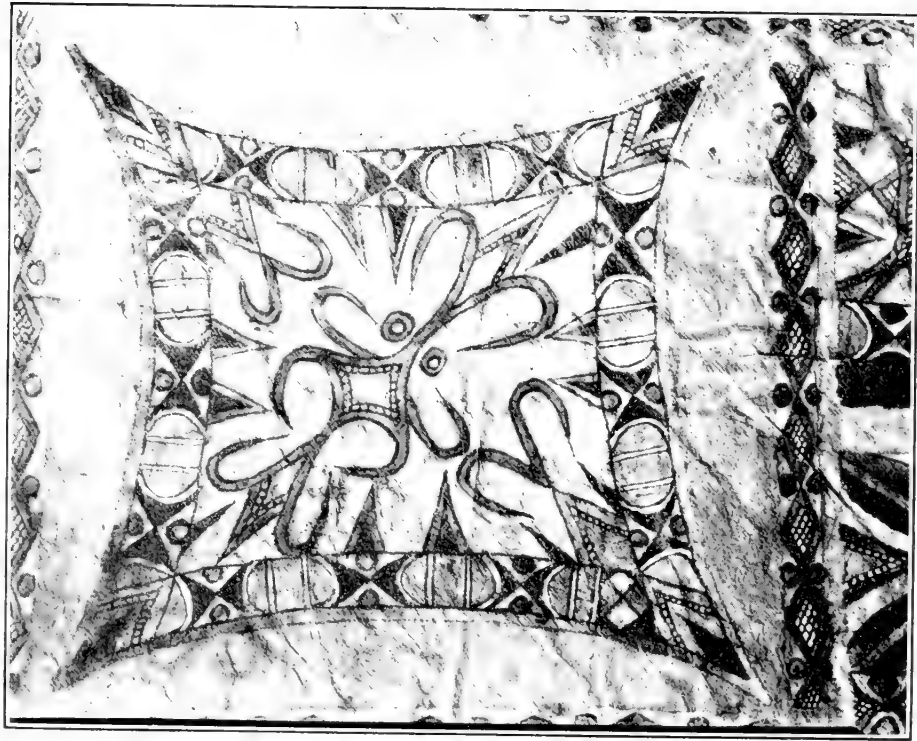
Women wear a headband and a skirt of coarse bark. A basket and a hoe would be carried, or whatever implements of labor were required.

Both sexes wear high-pointed palm-leaf hats, and women at work in the day provide a sunshade of bark cloth hung to the hat. Women's skirts are gathered and are bordered with bark cloth of a different color or sometimes openwork and appliquéd with white, red, and yellow bark cloth as in girls' fancy dress.



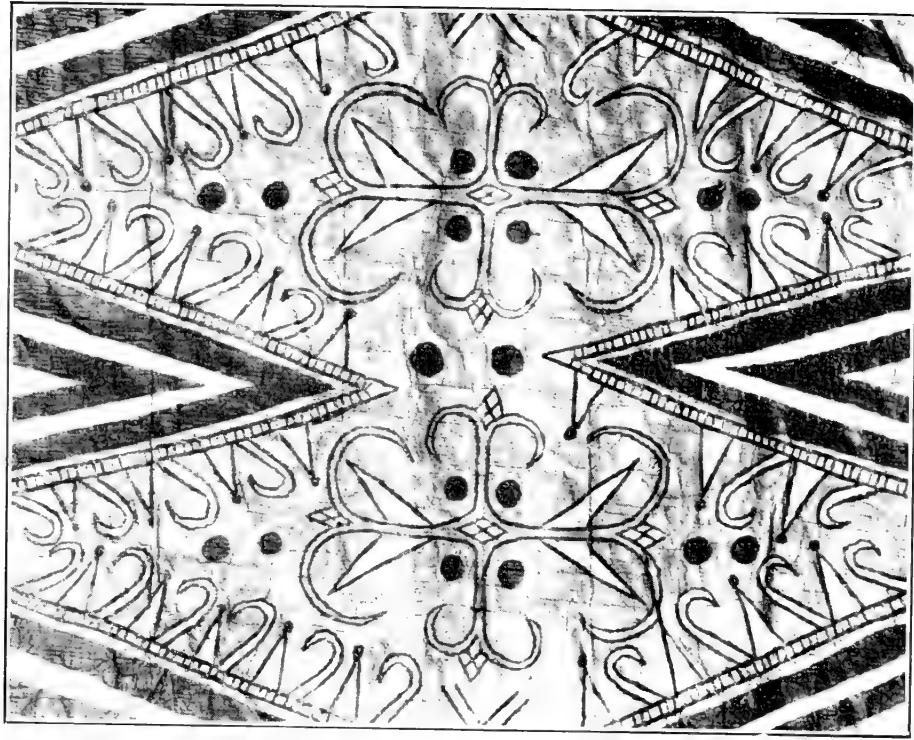


CARVED HOOKS AND SPOONS FURNISHING KEY TO BUFFALO DESIGNS  
66994—32—2



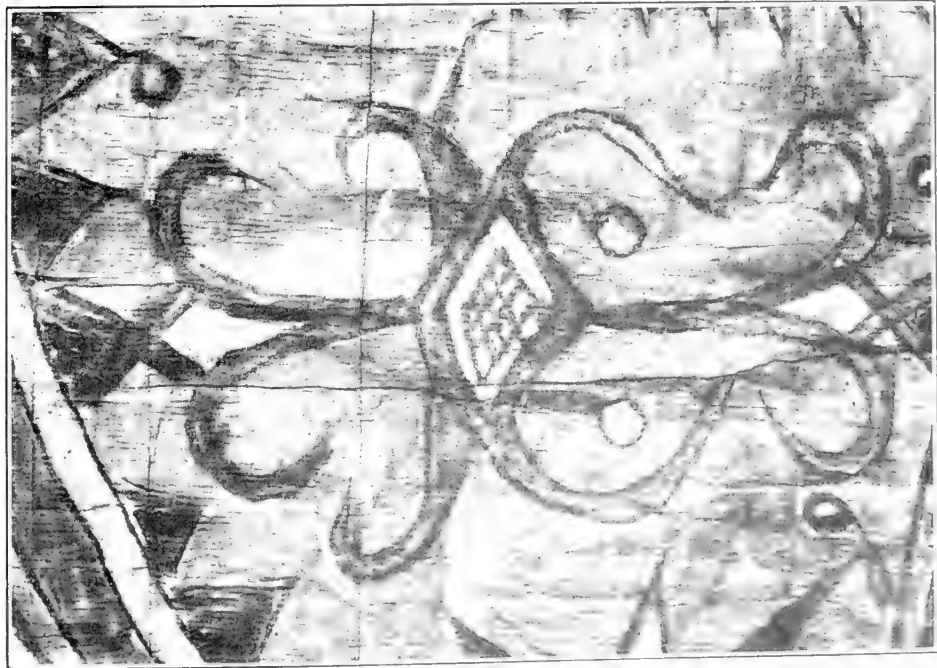
"a", BARK CLOTH SHOWING COALESCENT AND INTEGRATED UNITS

U.S.N.M. No. 301102, Bada, Toare.

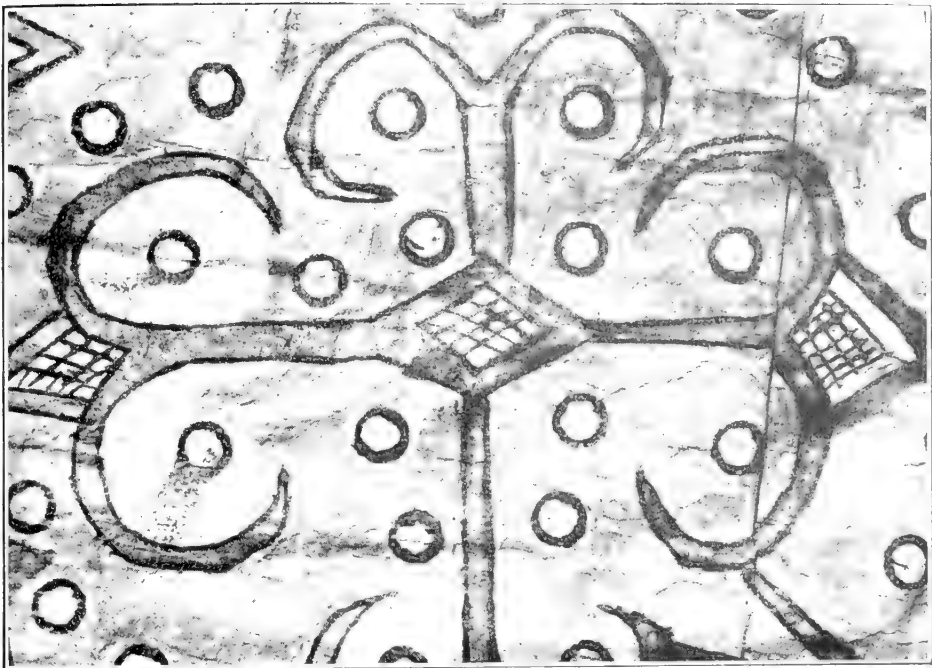


"b", BARK CLOTH BAG WITH DESIGNS DEMARKED IN LARGER UNITS

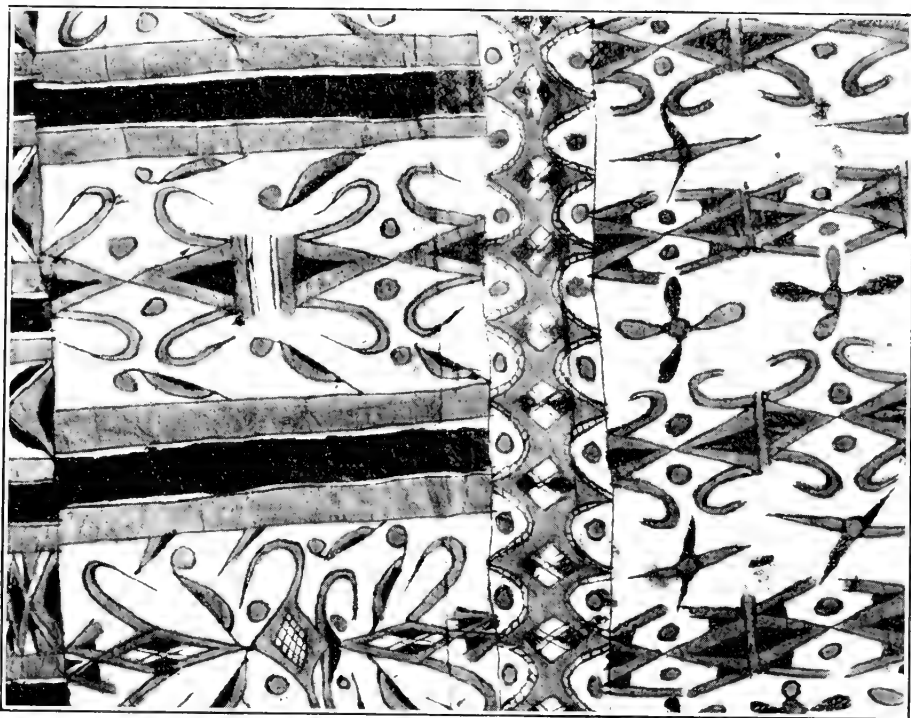
U.S.N.M. No. 301103, Bada, Toare.



a, DESIGN DOUBLED, BUT WITH ONLY TWO EYE SYMBOLS  
U.S.N.M. No. 30102.

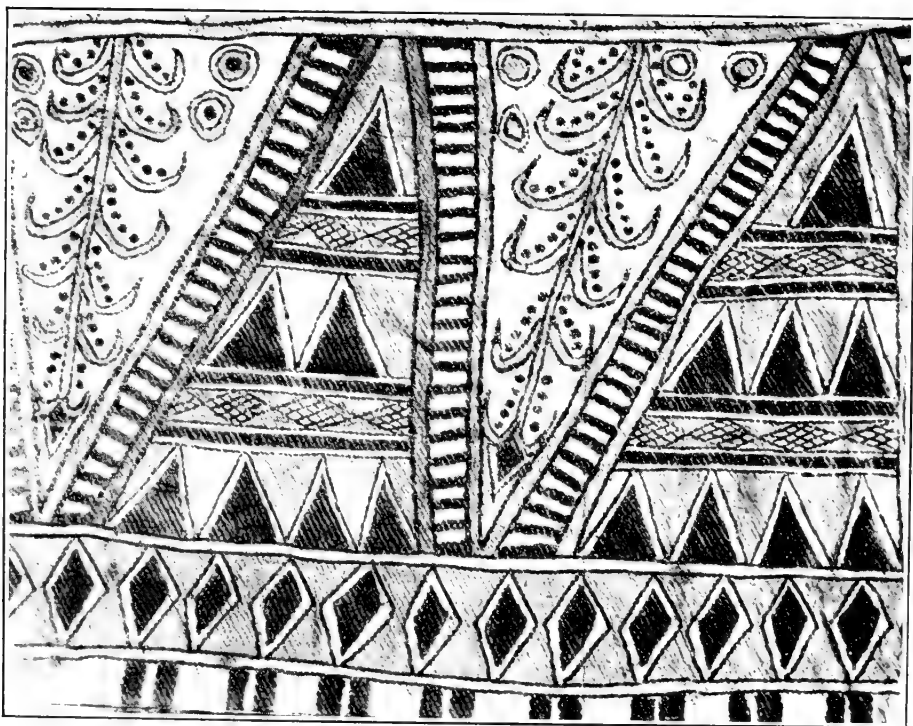


b, DESIGNS ON 4-PART BASES WITH MANY EYE SYMBOLS  
U.S.N.M. No. 30103



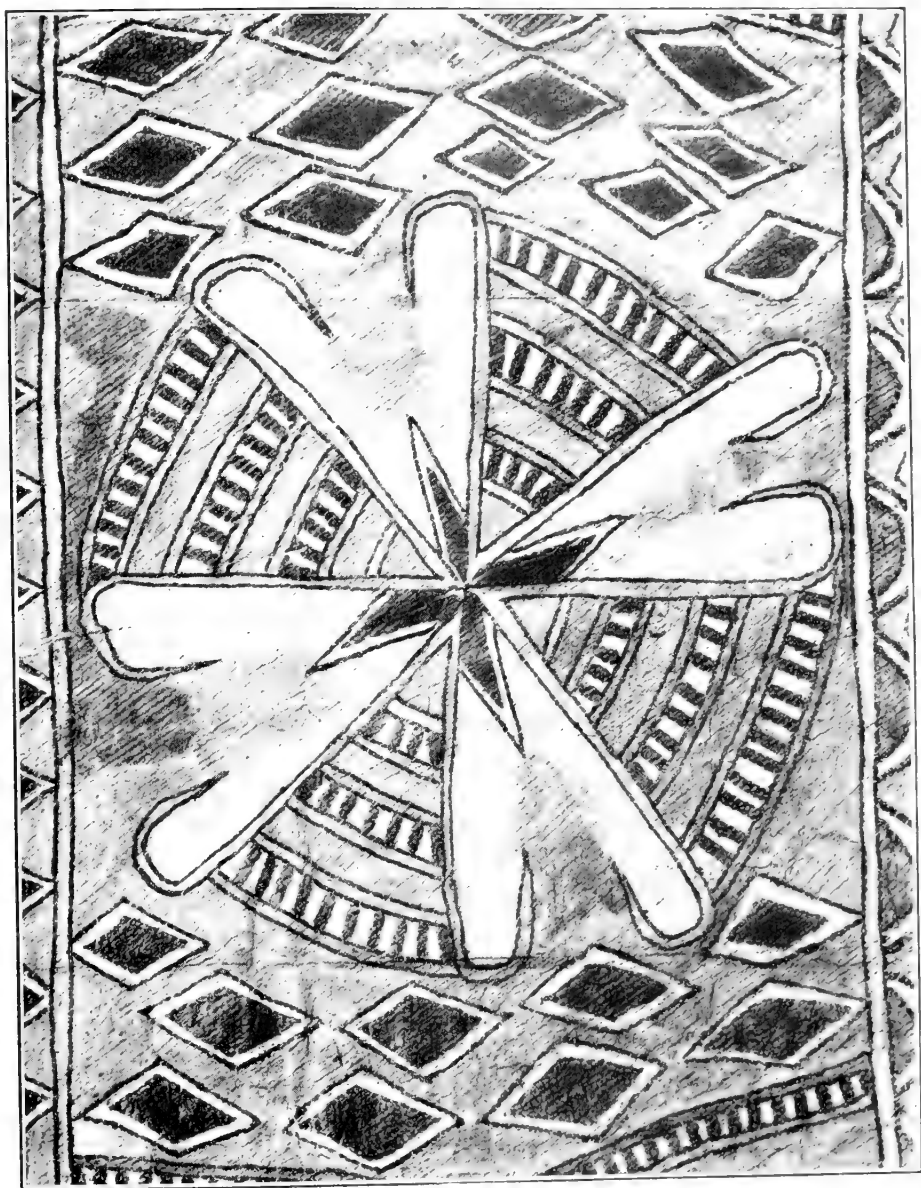
*a*, DESIGNS OF GREATER PROLIXITY USING ALL ELEMENTS

U.S.N.M. No. 304119.



*b*, WEDGE-SHAPE DESIGN OF HORNS AND EYES AND GEOMETRICAL FIGURES

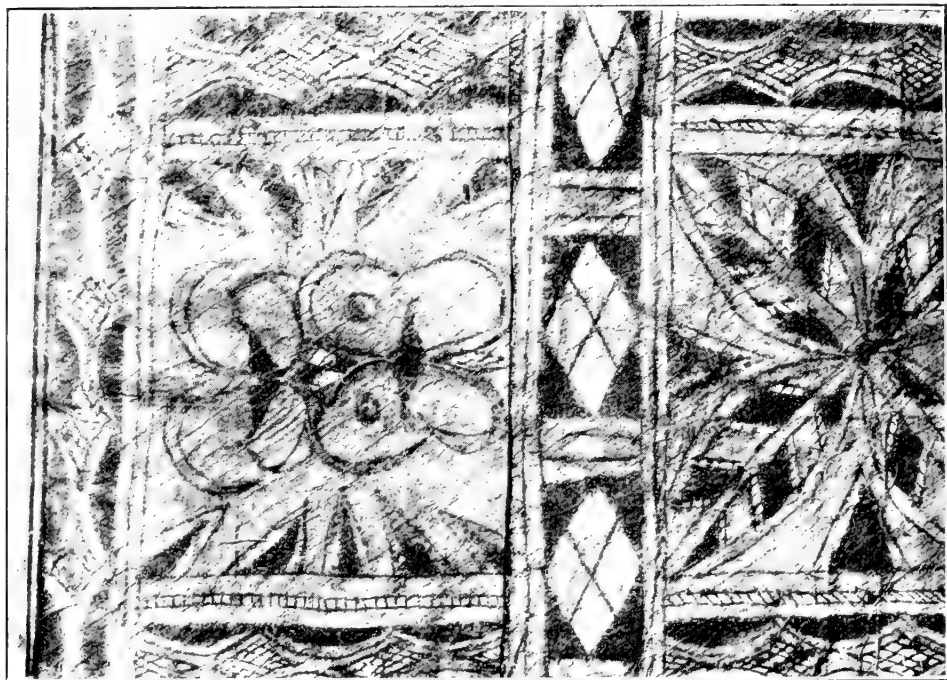
U.S.N.M. No. 304117, Bada, Toare.



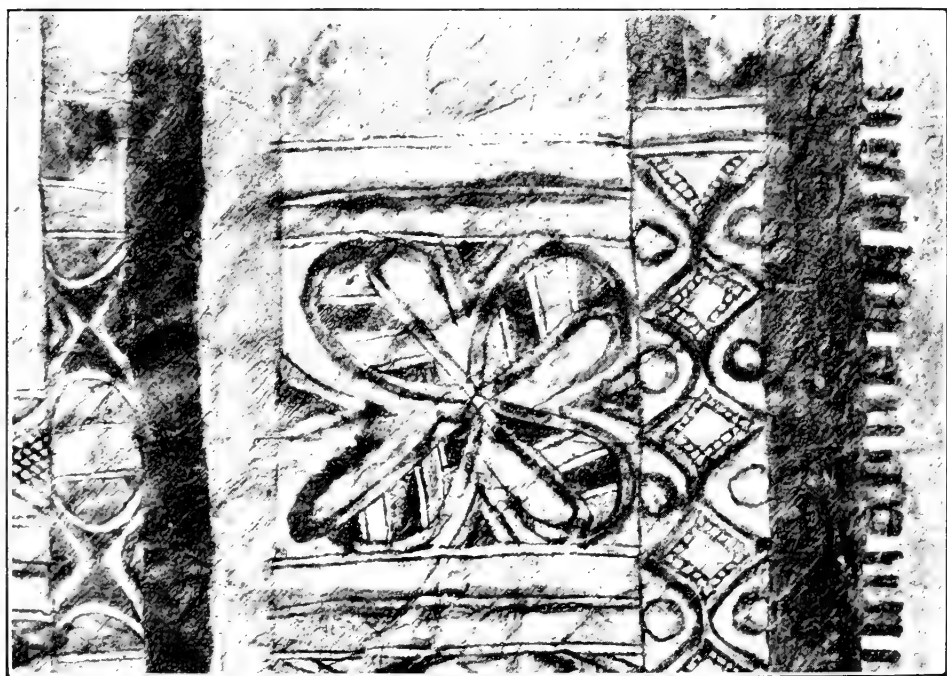
FOUR-PART DESIGN SURROUNDED BY GEOMETRIC UNITS

U.S.N.M. No. 30417, Bada, Toare.

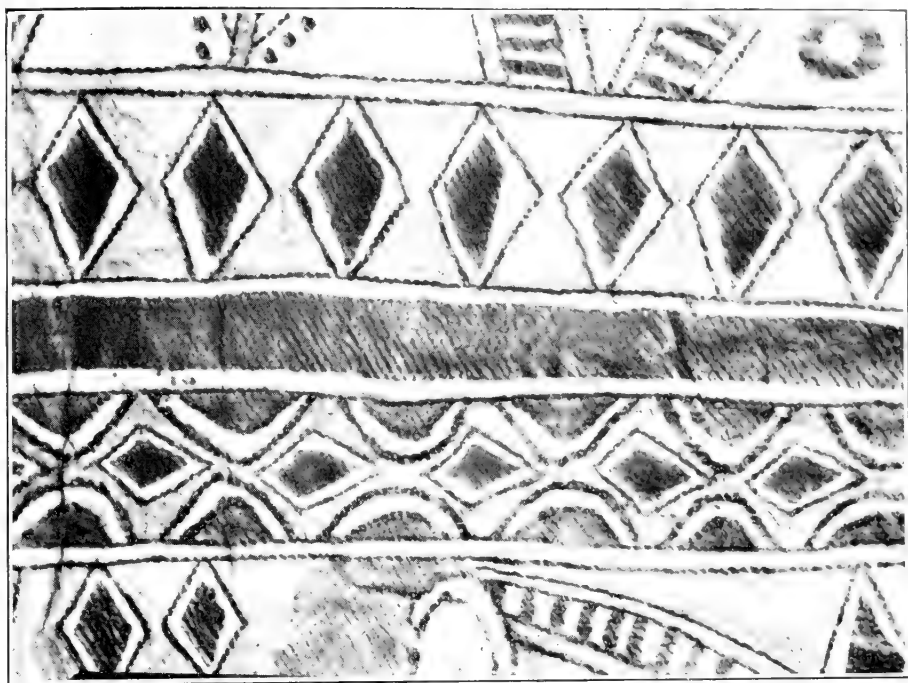




*a*, paneled designs surrounded by geometric borders  
U.S.N.M. No. 304121.

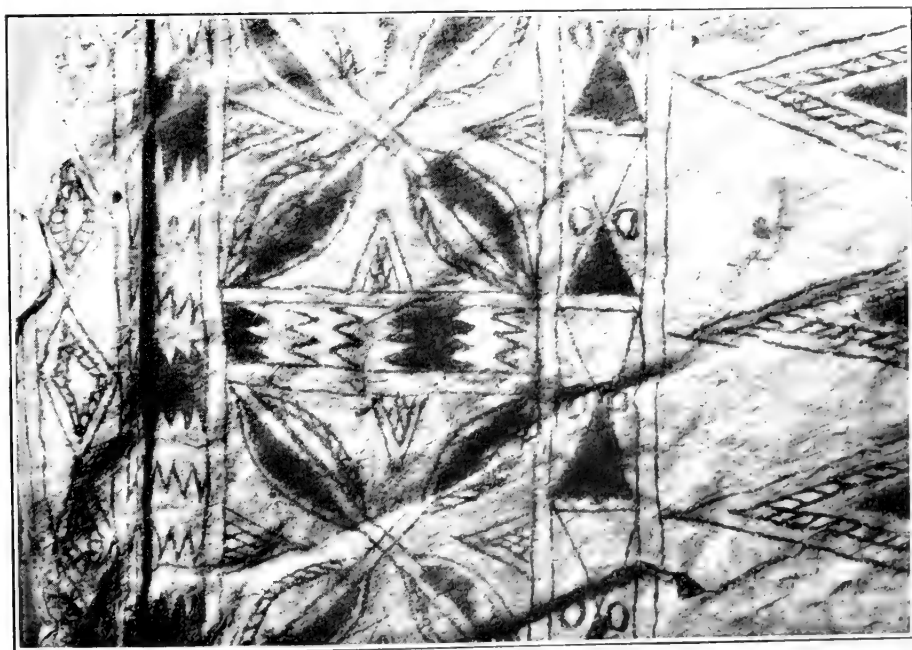


*b*, square design showing motion figure  
U.S.N.M. No. 304107.

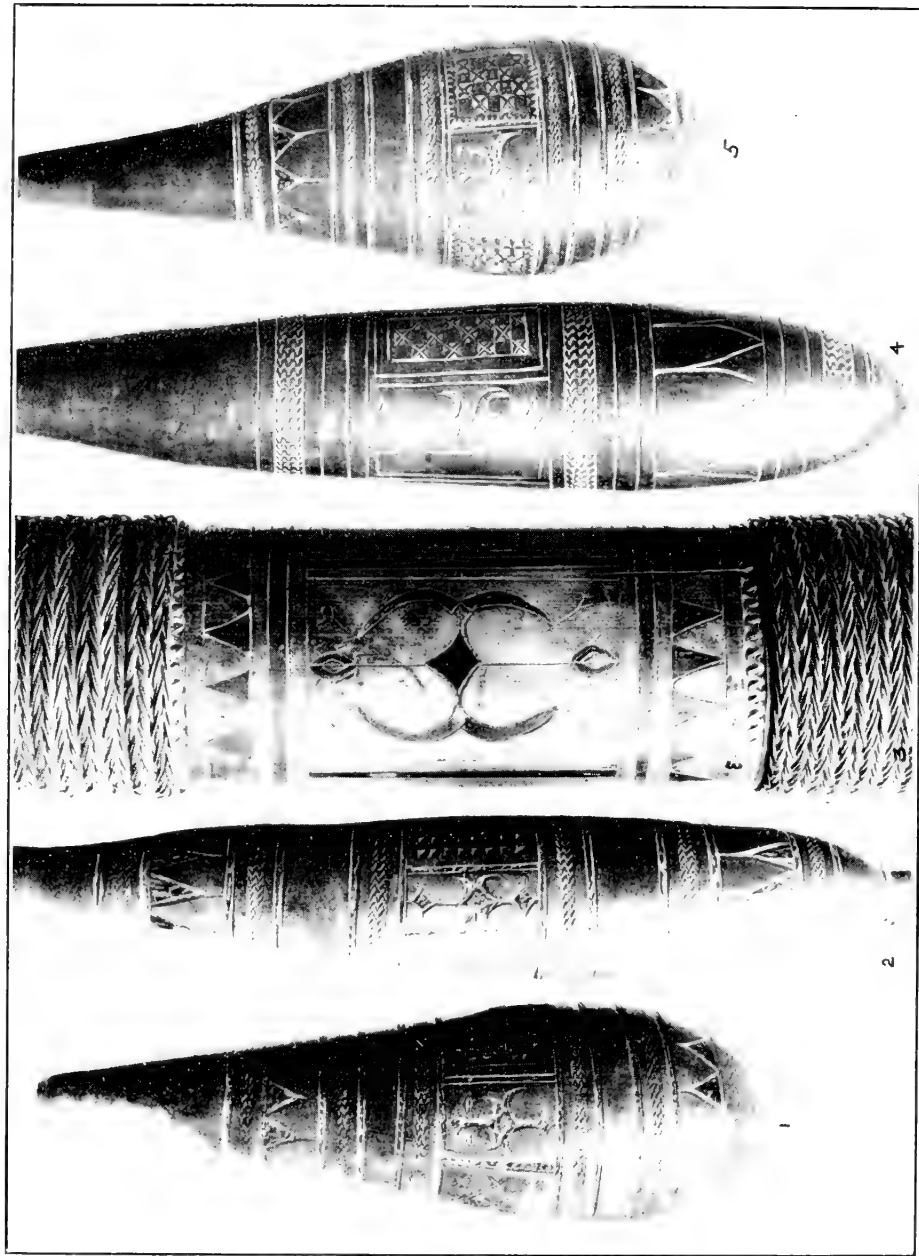


*a*, CONVENTIONAL 4-PART DESIGN WITH GEOMETRIC BORDERS

U.S.N.M. No. 304121.

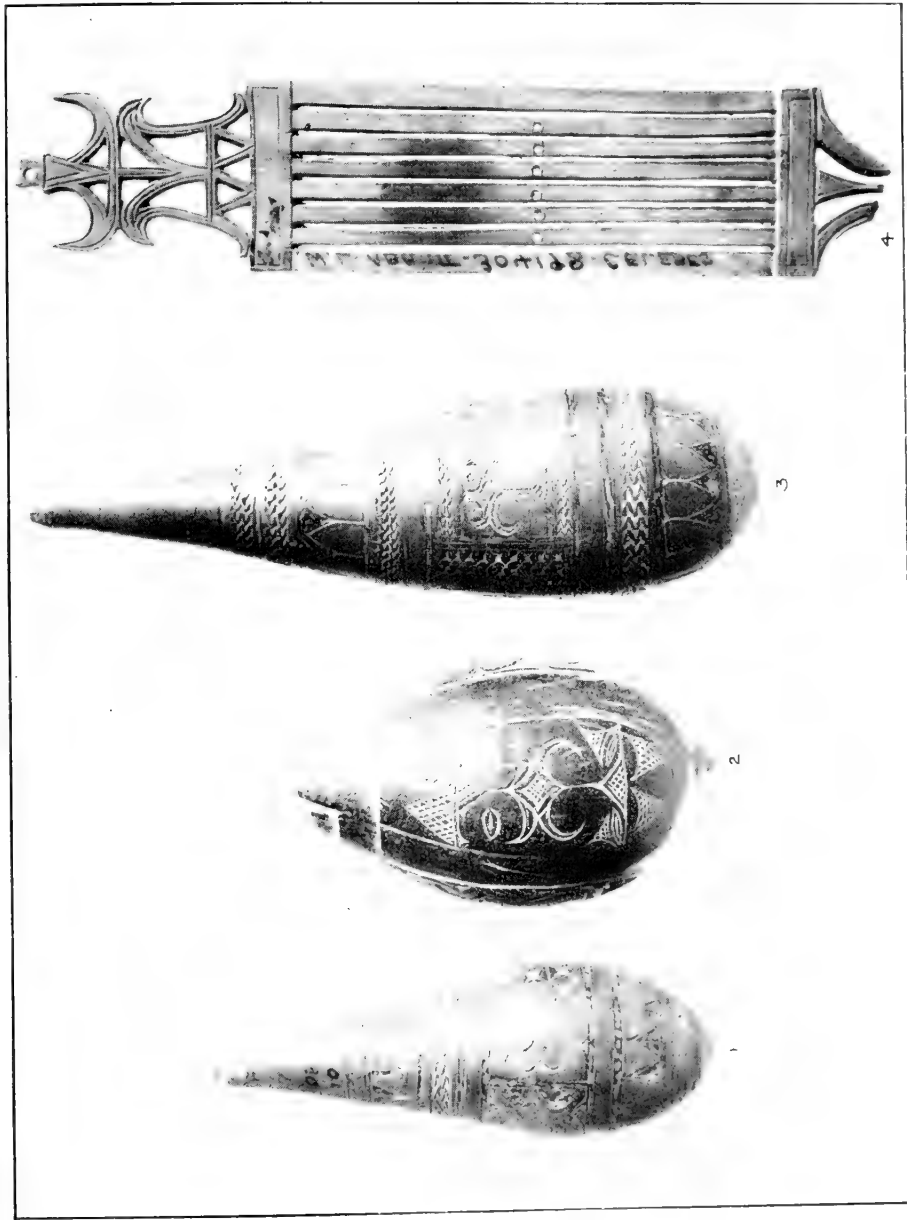


*b*, GEOMETRIC BORDER BANDS



GOURD AND BAMBOO CONTAINERS ETCHED WITH BUFFALO DESIGNS  
U.S.N.M. Nos. 304151 and 304193, all from Bada, Toare.





GOURD AND COCONUT CONTAINERS AND HORN WEAVING FRAME. BUFFALO DESIGNS ON GOURDS  
SHOW PRECISE ETCHING  
U.S.N.M. Nos. 304151 and 304198, Bada, Teare.



## CONTENTS

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	Page
Introduction.....	1
Micronesian arts.....	4
Distribution of Polynesian designs.....	4
Hawaiian decorative art.....	8
Decorative art of the Maori of New Zealand.....	9
Tonga-Samoan art area.....	11
Tapu cloth, leaf girdles, necklaces.....	12
Mats.....	14
Tattooing.....	15
Headdresses.....	17
House furnishings.....	18
Polynesian stone structures and images.....	19
Artistic ability of the Fijians.....	20
Melanesian art.....	21
Aboriginal Australian design.....	23
Papua and New Guinea.....	26
Negritos and Papuans of Central Dutch New Guinea .....	26
The Andamanese.....	35
The Nicobarese.....	36
Sinhalese art.....	37
Elementary decorative art of the Veddah.....	37
Cultural affiliations in Indonesia.....	37
Malayan decorative art.....	38
Influence of culture stratification on Filipino decorative design.....	42
Malaysian basketry.....	44
Malaysian wood carving.....	45
Explanation of plates.....	47



# DESIGN AREAS IN OCEANIA

BASED ON SPECIMENS IN THE UNITED STATES NATIONAL MUSEUM

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## INTRODUCTION

Primitive art, as usually understood, is the product of geographic areas and of peoples who have for some reason not shared in the technical development centering about metallurgy in Europe. Other great metallurgical centers, as southeastern Asia and central Africa, developed art styles more commensurate with local developments in culture generally and were not disturbed by the early organized diffusion of western trait complexes. Each of the more generally diffused elements of design, as the triangle and zigzag or alternate spur, the spiral, the swastika, and the meandered guilloche, has a distinct areal style which may never be mistaken when once one has become accustomed to it in its local setting.

There seems to be a key design peculiar to each distinctive art area that unlocks the secret of the origin of other designs from the same area. Frequently this key is merely the understanding of a conventionalized form as applied either to textiles or to wood carvings, such as the incised frigate bird designs of Polynesia, or the crocodile, water buffalo, dog, and leaf designs in Malaysia.

When man attempts to represent objects of nature through the graphic arts of drawing, engraving, or painting, he is confronted with the problem of showing three dimensional objects on a two-dimensional surface. Primitive peoples solve this problem in a manner different from ours. Perspective is utilized by the civilized artist to give a visual presentation of the object as it appears to us in photography. The primitive artist realized that such a view must exclude from vision certain features essential for its recognition; the eye, for instance, when the individual is seen from the back. The primitive artist puts into the picture what he considers most important. That his point of view is influenced not so much by momentary impressions as by the demands of a formalized art enables the student to classify and evaluate designs of primitive peoples.

Peoples having a developed art technic, whether symbolic, representative, or purely decorative, rarely possess pictographic ability. This is true for peoples of Oceania as well as for the American Indian. It is only when formalized art tends toward realism that a good picture becomes a possibility, as in the Magdalenian cave paintings.

Symmetry may be observed in Melanesian shields or in their designs on paddles and arrows, also on Polynesian dressing boxes of carved wood. Decorations of Melanesian houses have a rhythmic repetition of design motive. Banded patterns on bamboo, although differing one from another, are symmetrical in themselves and are repeated at rhythmic intervals, giving a pleasing effect for the pattern as a whole. The omission, inversion, and distortion of a pattern is carried out with almost mathematical precision. In formalized Polynesian art on tapa, stamped blocks, each incorporating a conventionalized life motive, principally aviform, are repeated at regular intervals. Perhaps the simplest form of this rhythmic repetition pertains to the pineapple and to the lotus-flower motive on brasses, bronzes, and iron objects from Malayan metal-work centers.

Modern Malayan art, incidentally, ranges far superior to prehistoric European achievement. It was only with the coming of Grecian influence to northern Europe that art forms developed there beyond the initial crude stages of the later stone age.

The axial cross, or almost all symbolism in the form of variants of the swastika, have a different application and different meanings attached as we proceed from country to country and tribe to tribe. The use of the spiral is so widespread as to be of no significance in itself, although the technic employed in its execution may betray the maker. Common alike to painted designs on Pueblo pottery in the Southwest and to etched designs on bamboo or wood in Polynesia or in lower Melanesia, we can everywhere in the two areas distinguish the maker by the crudity or excellence of workmanship. The spiral and associated double-curve design representing originally zoomorphic forms, such as the horns of the water buffalo in Celebes, or the frigate bird in eastern Polynesia, is almost mechanically perfect when incised on bamboo or gourds in western Polynesia. It is crudely done in Melanesia and New Guinea. Not only are individual designs poorly or well done in one area, but all of the designs share alike and take their cue from the quality of the key design. We may thus speak of the excellence or of the crudity of design as characteristic of art areas.

Wood carving is usually characteristic of peoples of the stone age. This is notably true of the Melanesian islanders. Their carving of representations of the alligator and of the frigate bird is

superb. The Polynesian art complex employs similar designs but the media of bark cloth sets this apart from Melanesian patterns. Tattooing is characteristic likewise of both Melanesian and Polynesian areas. Cultural habits complicate the explanation of styles in art still further. Squatting tribes, for example, naturally do not develop artistically embellished stools or seats. A development of art in hair coiffures naturally leads to the invention and ultimate artistic embellishment of a neck rest, as in Polynesia and Japan.

The wood carving of the Maori of New Zealand, with its repeated use of the incised surface spiral, may never be mistaken for totemic carvings in the round of the Haida Indians of southeastern Alaska and British Columbia. The same may be said of the peculiar style of wood carvings of the Marquesan islanders, or the Fijians. The specimens of the wood carver's art of the various peoples of the Pacific show an appreciation of form and line. It will be seen, however, that incised surface decoration is in the style of tapacloth ornamentation to a remarkable extent. Ceremonial adzes, clubs, paddles, stilts, etc., were treated thus with the most minute and patient work, employing the teeth of the shark as etching tools.

Figures carved in the round, although produced by the Maori, the Melanesian, the Fijian, the Hawaiian, and the Filipino, yet are sufficiently distinctive to become a key or index to the art of their respective geographic design areas. In carving in the round, certain subsidiary principles arbitrary in their nature lead up to differences in their execution. The element of grotesqueness, frequently misunderstood, enters into the designs of each of the areas just mentioned so far as carvings in the round are considered. The omission of parts, the repetition of others, the misplacement to fit the media on which the design is applied, all these principles are well understood by the primitive wood carver; yet for each there is a difference in style.

Of all areas of decorative design, the island world of Oceania is the most extensive. Its most easterly projection is Easter Island, situated near the American coast. In the west its most extreme projection is Madagascar, near the African coast, while in the north Hawaii lies in comparative proximity to the Aleutian Islands of Alaska. The customary explanation of Japanese culture derives it from the Asiatic mainland.

This mighty island world, Oceania, then, taken as an area together with its seas and oceans, includes approximately as large a space as Asia. It is naturally divided into eastern and western parts, the line of cleavage corresponding roughly to the one hundred and thirtieth parallel. To the west of this lie the islands of Indonesia, together with Madagascar, the western half of which may be classed as belonging culturally to Africa. Oceania has been privileged to

share the proximity of the great culture influences of the Asiatic peninsulas of Arabia, India, and southeastern Asia, that point like so many huge fingers in the direction of Indonesia and the islands of the East Indian archipelago.

Eastward of the one hundred and thirtieth parallel the smaller islands of Micronesia and Polynesia remained isolated in a stone-age culture level until the days of Captain Cook and other great explorers of the eighteenth century. Stirling and other recent explorers found tribes of the interior of the Melanesian island of New Guinea similarly still unadvanced beyond the stone age. Micronesia and Polynesia are nowhere contiguous to the coast of a continent or of a peninsula which might serve as a bridge for the transmission of culture traits. They are closely pushed together in separate isolated groups.

If we thus divide Oceania into an eastern Polynesia and Micronesia, and a western Indonesia, we have not included Melanesia and the islands centering about the great island continent of New Guinea. From the geographic viewpoint these two groups are closely related to central Indonesia, but from the viewpoint of culture connections the same is not entirely true. Indonesia and Micro-Polynesia are mainly inhabited by peoples who speak languages differing as to dialects but related as to structure, i. e., the Malay or Austric language. This linguistic similarity, however, does not extend to the Melanesians or to the Negritos and Papuans of Australia and of New Guinea and surrounding islands.

*Micronesian arts.*—The Micronesians dwelling in island groups such as the Carolines, Gilbert, and Marshall Islands typify a culture in which the knowledge of iron is lacking and useful stone is scarce. The arts of the Marshall Islanders are well shown by the weaving paraphernalia and excellent belts exhibited in the National Museum. Shell and fiber neck ornaments, seed necklaces, woodwork, basketry, and ornamental bamboo boxes illustrate the type of art used in Micronesia.

The specimens exhibited in the United States National Museum embrace shark's-teeth spears, coconut fiber armor, helmets of fish skin, drums, headdress, basketry, ornaments, coconut vessels, dippers, house models, lapboards, pillow, boat bailers, lime gourds, fish-hooks, awls, pump drill, daggers, dish, canoe prow, and oval mauls of coral rock and heavy wood for dressing the pandanus leaf used in basketry.

*Distribution of Polynesian designs.*—Polynesians apparently may account for their occupancy of such widely separated islands as New Zealand, Hawaii, and Easter Island by their skill in navigation. They observed the flights of birds and set out to find the lands whence came these birds. The cult of the frigate bird, which plays a great



rôle in the life of Polynesians and of Micronesians such as the Gilbert Islanders, developed through a recognition of the essential aid rendered them by this bird when sailing the outrigger boat literally from one end of the Pacific to the other. It is therefore not astonishing to find the frigate bird motive among the wonderful wood carvings of Polynesia. Notably excellent examples of this design may be seen on carved wooden paddles from Hervey Island. These paddles are completely covered with an open-work filigree carving incorporating the frigate bird motive.

The American mainland was apparently outside the main course of Polynesian travel, due, no doubt, to the lack of the flights of birds coming from that course. There was nothing to prevent the discovery, occasional landing, even the settling of the American west coast by Polynesians. They were competent to make journeys of a month's duration, covering greater distances than that actually lying between the coast of South America and the western outpost of Polynesia, namely, Easter Island. The outrigger boat, when equipped with Micronesian navigators who knew the courses of the stars, and who were provided with a crude sailing chart of bamboo sticks spaced on a bamboo frame in such a manner as to plot out the course, made it possible for Marshall Islanders to engage in deep sea voyaging far from the sight of land. Landings of Polynesian crews on continental America doubtlessly were made from time to time, as evidenced by the many items of culture similarity in tropical America and in Oceania. Similarities with Polynesia in the culture of certain Northwest Pacific coast Indian tribes, such as the Haida and the Tlingit, who excel in plastic sculpture, in wood carving and in stone working, have often been noted. One of these, infrequently taken into account, is the wide extent of Pacific coast area where the Indian tribes of diverse linguistic stocks possessed a knowledge of woodworking and of sculpturing. As this area extends all the way from central California to northern Alaska it is apparent that the design area is an old one. Old Malayan influence, discussed later, might offer a tentative explanation. In explaining such extensive design areas as Polynesia and the Pacific coast of America it is necessary to allow for elapse of great periods of time, perhaps, also, completely to disregard the possibility of tribes now occupying the region as having established such culture contacts as at one time undoubtedly existed.

It has been conjectured that the so-called Old Malayan or Early Indonesian population elements of southeastern Asia arrived on the coasts of the several Indonesian island archipelagos at an early date. Motivation for this early travel may have been desire for adventure, overpopulation, or simply desire for trade. At any rate they

found such groups as the Philippine Islands, the great islands of Borneo, Sumatra, Java, New Guinea, even the Malay Peninsula, in possession of a dark-skinned Melanesian population. Pausing for a time along the Melanesian coasts, and occupying large areas in Borneo, Java, Sumatra, the Philippine Islands and other islands of the East Indies, they wandered gradually eastward, occupying untimately the several island groups known to us as Polynesia. These islands in mid-Pacific they found unoccupied.

These early immigrants possessed the rudiments of a wood carver's art. Figurines representing the ancestral gods were carved from hard wood; representations of them were applied ornamentally to weapons and utensils. The use of paints was restricted to the medium of bark cloth which was used decoratively or as a bodily protective covering. The Polynesian artist was not master of such a large field as a robe of bark cloth. He therefore divided the field into zones when he applied his decorative designs in paint. He likewise had not learned how to portray plant, animal, or human forms. In this he resembles other primitive artists from other lands who, although possessing a conventionalized style of decorative art, yet can not break away from geometrical devices of a more unsophisticated nature. The realistic drawing of such tribal artists is crude. The Cheyenne and Sioux Indian drawings, for example, portraying horses, battle scenes, and hunting episodes, are similarly crude though the conventional geometric art of the Plains Indians is pleasing to the western eye and answers the requirements of many of the principles of design. The early undifferentiated "Old Malayan" art foundation blossomed out into what is clearly distinguishable as subareas of Polynesian design on such islands as New Zealand, Tahiti, Raratonga, Hawaii, the Marquesas, and Easter Island. This differentiation transpired before the time of the great European explorers in the sixteenth, seventeenth, and eighteenth centuries. Culture contact was had only with the culturally impoverished Melanesian, Papuan, and Negrito. In the Marquesas and in New Zealand they learned to carve wooden and stone gods of heroic size according to a design developed by them in their isolation.

The exceptional art patterns developed by the Maori and Marquesans must be attributed in part to Melanesian influences. The Maori learned to free themselves from the conventional division of the decorative field which may still be observed in the tapa cloth decorative designs of Hawaii and Tahiti. In their tattooing this may be noted only to a limited extent as the size of the skin surfaces to be ornamented is naturally determined and divided. The banded panelings in triangular and quadrangular figures appear along with realistically applied figures of birds, sea creatures, as star

fish, also centipedes and other figures. Tattooing is especially developed among the Marquesans, who tattoo the torso, face, arms, and legs, the whole according to a pattern charted in advance of the operation and conventionally divided into zones.

Weaving of baskets is peculiarly lacking in Polynesia, if we except the small fans and baskets not woven in twilled or twined technics capable of being used as decorative aids. Even pottery making is unknown to the Polynesians, as is generally the weaving of textiles. Adjoining Melanesian peoples, notably the Fijians, make an unpainted pottery, but like the Polynesians, possess no basketry or textiles.

In discussing the distribution of decorative art designs in Polynesia one might refer to six distinct geographical design areas as showing differences in art forms and modes of application of design. These are: Tonga-Samoa, New Zealand, Raratonga-Tubuai-Tahiti, Manihiki, the Marquesas, and the Hawaiian Islands.

The Tonga-Samoan area is characterized by the use of straight lines, zigzags, and a derivative, namely, the dentated line. There are some delineations of animals and men. The Fortuna Islands, Tutuila and Rotuma, situated within the confines of Melanesia, and perhaps the small archipelagos of Tokelau and Ellice, appear to belong to this group so far as pertains to decorative design.

In the New Zealand area curved lines with a pronounced tendency toward spirals show a clear relation with Fijian and Papuan types of etched and painted designs.

Stylistic art patterns in New Zealand, as in the Pacific Northwest coast area, are fixed and standardized, the spiral perhaps being the most recurrent device in this subarea of artistic design of which the Maori are the chief representatives. Blanket robes of the Maori have a broad border in colored patterns, principally black, in straight lines, zigzags, and triangles, while the field is plain white. This is more in harmony with other Polynesian designs. Raratonga-Tubuai-Tahiti has for its key designs a geometrical series of zigzags, semicircular and dentated lines.

In the Manihiki area sculptures in wood are for the most part unknown, but small plaques with incrustations of shell nacre arranged in symmetrical form are found.

The Marquesan area designs are more conventional; among them are found two types of human faces, strongly stylized. Examples of this art are represented in the National Museum collection in the form of carved wooden stilts and a dagger with carved figurines in high relief. This latter example of Marquesan design (U. S. N. M. No. 5345) was collected by Captain Aulick, U. S. Navy.

In the Hawaiian area straight lines are decorated with nodes, or in zigzags or angles. Straight lines are parallel or cross them-

selves, forming lozenge-shaped designs reinforced with dots or curved lines.

In an area as large and as heterogeneous as is Polynesia there are but few art elements common to the entire area. As one passes from west to east there is a developmental sequence in the plastic art; the hieroglyphics of the island of Paques are the last stage in this progressive series. The island of Niue presents a distinct phase, however simple. The islands of Poumotu and Gambier are little known from the point of ornamental designs.

Passing to the Raratonga-Tahiti group, we find designs derived from anthropomorphic models. Tahitian objects are rare, but the products of Raratongan art (Hervey) are well represented in museum collections. All objects appear to have a religious significance. Ceremonial adzes with handles of carved palmwood (U. S. N. M. No. 3719), collected by Wilkes in 1838, are probably the most exquisite examples of wood carving known among primitive peoples. Wrapping of sennit cord secures the stone blade. The rectangular pattern of filigree openwork with which the handle is carved resembles lace work.

*Hawaiian decorative art.*—Hrdlicka, in speaking incidentally of the Hawaiians, says that they do not represent a pure ethnic group, but carry in all probability the blood of the yellow-brown Indonesian, and even Melanesian and Negrito ancestry. This implies that the fundamental type is a yellow-brown or Mongoloid.

There are exhibited in the National Museum collection examples of the principal classes of objects produced by the Hawaiian for the material needs of social life. There are shown excellent examples of stonework consisting of poi pounders, adz blades, net weights, game stones, lamps, mirrors, divination stones, sling stones, grinding and polishing stones, and pestles. Woodwork is represented by platters, kava bowls, bark beaters, and polished coconuts serving for drinking cups. Gourds were enclosed in complicated network and used in carrying and serving food. Smaller gourds were used as cups and rattles. Sperm-whale teeth were worked into ivory hook-shape ornaments, especially into pendants, to which were attached braided cords of human hair and which were valued as fetishes. Several rattles, a musical bamboo, nose flutes, a whistle, and a time-beating stick; ornaments of feather, shell, and nuts; pens for decorating tapa; and fly brushes used by chiefs, are shown. The pearl shell was employed in the remarkable fishhooks made by the Hawaiians. Beads were also made of shell, which resemble those of the California Indians. The Hawaiians prepared a fine even cord of sennit and they were wonderfully skillful in knotting the cords into a pleasing structure, as the carriers for calabashes and bowls. These are sometimes veritable

works of art and form a variety of lace. Marionettes of carved wood and imitation leather capes are paraphernalia of the Hulu dance.

The foundation of the well-known Hawaiian cape is a network of olona, or "native hemp," and to it are attached by means of fine threads of the same material the feathers of native Hawaiian birds. The feathers overlap each other and lie flat, forming a smooth surface. The upper and lateral borders, which are corded with a string of olona, are decorated with alternate tufts of red, black, and yellow feathers. The groundwork is yellow, ornamented with crescents of black and red feathers. In front are two crescents of red, one above the other, one-half of each crescent being on either margin, and they form the full crescents when the cape is closed in front. The inner surface is without lining and shows the olona network and the quill ends of the feathers.

The cord of the upper border is prolonged to serve as a fastening at the throat. The yellow and black feathers are obtained from the Oo (*Acrulocercus nobilis*). The yellow feathers are of great value, as the bird is comparatively rare, very shy, and difficult to capture. It has but a small tuft of these feathers upon each shoulder. Its general plumage is of a glossy black, and from the breast and back are obtained the black feathers. The Oo is taken alive by means of birdlime; the yellow feathers are then plucked and the bird released. The red feathers are from the body and neck of the *Vestiaria coccinea*, the most abundant bird of these islands.

A cape of this description was presented in 1841 to Commodore W. C. Bolton by Kamehameha III, King of the Hawaiian Islands. Capes such as this were formerly the royal robes of state and were considered the principal treasures of the Crown. Length, 17 inches; circumference, upper border, 16 inches, lower border, 66 inches. Accompanying this cape is a cylindrical bag of yellow feathers or leis to be worn on the head.

*Decorative art of the Maori of New Zealand.*—The Maori are in possession of several distinctive styles and subjects in their decorative art. Noteworthy among these is the carving of the so-called *tiki*—an ancestral deity figurine which plays an important part in their cult and decorative art complex. Though a sacred image, the resemblance to the outline of a human foetus is remarkable. Body tattooing is occasional among the Maori but they do a complete job in facial tattoo. The employment by the Maori of incised or applied surface spirals in complex patterns is foreign to the rest of Polynesia. Spiraled designs are etched by them on the outer surfaces of their wooden bowls and trinket or dressing boxes. Their idols and sacred images are carved, however, in true Polynesian style. The figurines representing ancestral deities vary from island to island. be-

traying thereby a long period of independent growth in design from each of the Polynesian subareas of decorative design. The wooden marionette figurine is a good example of such local variation, through still conforming to the conventional Polynesian style of wood carving. Samoa and Tonga do not possess decorated wooden carvings or decorative designs in the form of line plays. The Maori, like the Marquesans, but unlike other Polynesians, persist in ornamenting the carved surfaces of their wooden implements of diverse description with curvilinear designs. This, as in European rococo art, consists in the application of spirals and of counterspirals locked together. This device resembles that of the Dyaks of Borneo, who thus conventionally represent the interlocking tails of two dogs. Midway between New Zealand and Borneo in the so-called Massim area appear similar hooked spirals. The design blossoms into the concentric circle, so frequently applied as a frieze decoration when daubed over with red paint in the gable end rafter projections appearing at the front of Maori houses. The thick planks of the wooden ancestral pillars supporting these houses have similar decorated surfaces filling in the spaces between the grotesque faces of an ancestral deity. These are deeply incised and inset with shell, the whole being painted over with a red ocher.

Meandered spirals appear incised on the surfaces of the musical bull-roarer of the Australian-Papuan culture area, also on the painted wood carvings of a semisacred nature. As mentioned previously, the richly carved boxes and the ancestral deity figurines are never painted by the Maori, who thus conform to Polynesian rather than to Melanesian art impulses. The spiral design is used by the Maori principally in wood engraving. The spirals are double and are placed in interlocking patterns, or volutes. Boxes of wood cut out of the solid, tattooing, house gable decorations, and house foundation posts—these are some of the typical media on which are placed the spiral patterns in connection with diverging lines, spurs, nucleated cores representing eye forms, and other facial features, or any feature breaking up the continuous spiral, but blending into it. The design overlaps into Melanesia as shown in the cut devices on shields from eastern New Guinea.

Carving in the round is a characteristic of the Maori woodworker, who resembles in this respect the artisans of many other areas, notably Melanesians and Northwest Pacific coast Indians, each in a broad way contiguous to the area of the Polynesians. The art of wood carving in the South Pacific is imitative in that the designs are similar to those used on more flexible materials such as the woven fabrics in Tonga.

In comparing Polynesian textiles, the contrast between the feathered mantle of the Hawaiians just described and a Maori man's cloak

exhibited in the National Museum is of interest. The material is finely prepared *Phormium tenax*, or New Zealand flax, twined with great accuracy and neatness. The border is formed by dividing the warp into numerous strands intertwined with black-dyed flax and red strouding (bayeta), producing lozenge patterns in great variety. The edges of the cloak are bordered with a narrow geometrical pattern of close twining which is continued from the border of the garment. The upper edge is finished with a sewing of red and black cord and is supplied with two tying strings. The robe is a fine example of the best textile work of the Maori. The material has aged to a fine brown color and has taken on a silky luster. Collected by Edwin Smith, United States Geological Survey, in 1883. Length, 38 to 45 inches; width, 52 inches; bottom border, 7 inches wide; side borders, 1 inch wide.

*Tonga-Samoan art area.*—Samoans of to-day have been affected as to the nature of their clothing by the distance from the centers in which the whites live; also the inconvenience of the old Samoan dress has caused them to adopt cotton materials for clothing. The men and children wear a lava lava or loin cloth knotted about the waist and reaching to the knees. The men usually wear a cotton undershirt and on official occasions a white coat.

The women wear a loose wrapper or a skirt and loose sack, or the skirt may be replaced with a lava lava. At the siva siva, or ceremonial dance, and other purely Samoan ceremonial affairs, olden types of costumes and ornaments are seen, especially those of the women and the costume of the taupo, or village virgin.

The Samoans are skilled in making mats, buckets, and fans from pandanus and palm leaf, these plants yielding excellent material for the purpose. Mats are made of exquisite fineness and are valued as heirlooms. These mats are trimmed with red feathers of a parrot. Baskets are woven in checker designs in black and natural colors, and fans are constructed in beautiful forms and patterns. There are exhibited in the National Museum wooden dishes, clubs, spears, adzes, combs, fly brushes, ornaments, and a drum. A large kava bowl was presented to President Grover Cleveland by Malietoa, King of Samoa. The exhibit also consists of ceremonial dress, dance head-dress, ornaments, combs, pillows, paddles, spears, and fishing appliances.

Breadfruit, bananas, taro, potatoes, and coconuts furnish the principal food supply, and fish are eaten. The only domesticated animal is the pig. The Samoans are robust and active, their war-like exercise with club and spear, and their constant practice with the canoe paddle developing a fine physique. They are cleanly, and delight in flowers and perfumes. The men excel in woodworking,



in building elaborate houses, in making large canoes, and in carving out bowls, dishes, clubs, and spears from the Samoan chestnut. The women weave mats of the finest texture, and beat out bark cloth of strong fiber with corrugated clubs, decorating the fabric with native designs in color.

The Samoans are of the brown Polynesian race which at some early period spread over the Pacific to numerous widely separated islands and reached to within 1,800 miles of the South American Continent. The Samoan Islands were visited by the Dutch navigator Roggoveen in 1722, and named by Bougainville in 1768. Like the Hawaiians, Samoans live in villages which are scattered along the coasts of their tropical islands. They were formerly ruled by hereditary chiefs, but as the islands now belong to the United States their governments are accordingly administered by naval officers.

*Tapa cloth, leaf girdles, necklaces.*—The making of tapa cloths is one of the oldest native industries of the Samoans, Fijians, Hawaiians, and of other Pacific islanders. These cloths of beaten bark are now used mainly for decorative purposes during festivals and ceremonies. They were originally used as lava lavas, a kind of loin cloth worn by Polynesians; also as robes. They are still used as objects of wearing apparel to a limited extent, although natives find the imported cotton and other European textiles more satisfactory.

Tapa cloth is a primitive type of paper, although not fashioned from the pulp of the wood. It is rather made from the bast of a species of mulberry tree, which grows abundantly throughout Polynesia and which in past years was especially cultivated. When 3 months old it is cut down and its bark stripped from it. The bark is then tied together in bundles and weighted down in fresh water, where it is allowed to soak for about a day. After this soaking the strips are placed on a flat board and scraped with a mussel shell. After they are scraped clean they are beaten with sticks on a round log which causes them to spread out into wider strips. The root of the arrowroot, which resembles a plant bulb, is then boiled and the skin removed. It is then used as a sort of gum for sticking the different strips together. It is rubbed along the edge of one strip which is placed upon the edge of the other and in this manner they are joined, forming cloths of various dimensions.

The cloths are then dyed and painted with patterns for which nothing but native-made vegetable dyes are used. Wooden patterns are made, the white tapas are placed upon them, and with a cloth the dye is rubbed all over them. In this manner the pattern is transferred to the tapa cloths. In some cases the patterns and figures



are painted by hand on the cloths, the fruit of the pandanus tree, which makes an excellent paintbrush, being used for the purpose.

The Samoan bark cloth, or tapa, is not so fine as that of Hawaii and other parts of Polynesia. It is coarse and for the most part crudely decorated. It is manufactured from the u'a, or paper mulberry (*Broussonetia papyrifera*), a plant propagated by suckers and cultivated sparingly.

The bark of the slender sapling is removed and prepared by soaking, peeling, and macerating. The strips are then beaten with the square tapa mallet or beater into long strips. The holes and thin places are filled or thickened by strips attached by paste made from masoa, then the fabric is ready for painting.

The patterns are placed on the tapa by blocks of two kinds. One has a raised design cut out of solid wood; the other is composed of a frame with the ribs and fibers of the pandanus and the coconut arranged in a pattern. Striping with brushes and freehand painting are also practiced.

The colors used are yellow from the fruits of the loa, red or black from the sap of the hibiscus, bluish gray from the juice of the stem of the soa'a, and dark yellow or dark red when slaked lime is added to the juice of the nonu, and brown when it is added to the juice of togo or pau'i.

The dry and bleached tapa is laid over the pattern block or frame, its edges weighted down with stones, the dry color sprinkled over it and rubbed with a bit of tapa so that the raised design alone retains the color. This is repeated for each field of the design, sometimes a field being gone over with two colors to blend, and then, the patterns having been outlined in colors, they are fixed with the juice of the o'a.

Tapa is still worn at times, especially by chiefs and taupos (village virgins), and is often seen in the villages remote from the trading centers.

Previous to the introduction of American and European trader's goods, such as calico and other cotton prints, the Samoans sewed together an apron from ti leaves (*Dracaena terminalis*). The man had a small apron about a foot square and the women had theirs made from longer ti leaves, reaching from the waist down below the knees and made wide so as to form a girdle all around.

Leaf girdles (titi) now appear only in the siva siva, and are made from the colored varieties of the ti. The leaves are gathered fresh, split lengthwise, the midrib removed, and the pieces strung in one or more rows on the midrib of a banana leaf. For a dance they are considered most ornamental when made to shine with coco-

nut oil. The titi fatupona was a girdle which lasted for a week or longer, and was the type worn commonly in earlier times.

Necklaces of a permanent character are made from various seeds and shells, and are commonly used as gifts at parting. The seeds used generally are those of the lopa samoa (*Leucaena glauca*), which are brown, and those of the sanasana (*Coix lachrymajobi*), light bluish white. These are perforated and strung, either of one sort or of two or more sorts mixed in a definite pattern, and often mixed with the shells of land snails, forming very pleasing necklaces. Armlets of small white shells were worn by the men above the elbow. Some pierced their ears for flowers. A long comb made from the stem of the coconut leaflet was a common ornament for the women, and was worn in the hair behind the left ear. These combs are much inferior to the beautifully carved combs of whalebone used by the Maori of New Zealand, which are very rare. The splendid examples collected by Wilkes, now in the National Museum, are among the few extant specimens of this form of Polynesian carver's art.

*Mats.*—The early Fijians and Samoans prized fine mats and considered them their most valuable property to serve as a medium of exchange. They were preserved with great care, some of them passed through several generations, and as their age and historic interest increased they were the more valued. Many of the oldest and best mats had distinct names given them, and acquired great value if they had been used as "top mat" at any great occasion, such as at the marriage of some celebrated taupo (village virgin) or at a peacemaking on the conclusion of some war. Many of the most valuable mats are old and torn shreds of the original mats, but they are eagerly sought after by the Samoans.

The fine mats are made of the leaves of a species of pandanus (paono) leaf scraped as thin as writing paper and slit into strips about one-sixteenth of an inch wide. Fine mats are made by the women, and when completed are from two to three yards square. They are straw or cream color, are fringed, and in some instances ornamented with borders of scarlet feathers. A small species of parrot is kept in captivity for this purpose. These fine mats are thin and almost as flexible as a piece of calico. Few of the women of to-day can make them, and many months or even years are sometimes spent in making a single mat.

Another kind of mat is the ie sina, a white shaggy mat woven or plaited so as to be smooth on one side and shaggy on the other. When bleached white they are rather like a fleecy sheepskin. The projecting fibers may be as long as 6 inches. The shaggy mats often were colored with red clay or a red earth mixed with coco-

nut oil. The ie sina are very scarce, and the art of making them is almost lost, if not entirely so. There are villages which do not have a single shaggy mat.

Some of the fine mats are for costume purposes, others are in the nature of house furnishings. They are used only by the chiefs of high rank, and then only on ceremonial occasions and in an official capacity.

*Tattooing*.—Among the dark-skinned races of Africa, Australia, and Melanesia, tattooing is replaced by the artificial production of raised scar tissue on the body or face, forming designs in relief. This so-called cicatrization is a decorative technic not productive of elaborate or pleasing decorative designs. Asiatic races, Indian tribes generally throughout America, and Oceanic peoples, however, understand thoroughly the tattooer's art which is universal among them. The word *tatu* is of Tahitian origin, its American equivalent meaning "to mark." Among the peoples mentioned the process of tattooing was attended with ceremony, while among the Polynesians the fact that a boy is tattooed signifies he has entered the ranks of the men.

Nowhere is tattooing more effectively applied from the standpoint of esthetic art than in New Zealand. The tattooed faces are wonderful examples of the artist's skill in the application of spirals and of curved line etching. These lines are usually centripetal and cover the entire face, including the lower lip and nose. There are no straight lines and the designs vary from individual to individual, but are symmetrical and conform to stylistic patterns. In Polynesia the decorations appropriate to objects of material culture, such as houses, are different from tattooed designs. Designs applied to cloth or incised on bows of canoes are different again.

In the Marquesas Islands, tattooing occurs in series of triangles of solid color on rectangular bases. These designs tattooed on the body and legs are said to be symbolic and to represent in part mythological events. In part they are merely decorative, depicting animals, mainly the turtle and crustaceans.

According to Samoan legend, tattooing originated in Fiji, where at first only the women were so decorated. In Samoa and in the Marquesas the men alone are tattooed. At the present time, owing to the influence of European and American culture, a native sense of propriety leads them to cover the tattooed parts of the body. The abundance of trader's cotton goods is also a contributory factor. The practice is gradually discontinued as useless and expensive. There is no longer an incentive to bear the pain involved.

In Polynesia a boy is ineligible for marriage until he becomes tattooed. This, of course, before the introduction of western ideas. When application is made for the services of a professional tattooer, a present of a fine mat is made, the acceptance of which is sufficient to make the contract binding. A house is set apart for the scene of the operation. A number of young men are tattooed at the same time and a number of tattooers are employed. Instruments used are shaped from human bone, the serrated edges of which resemble a fine-toothed comb. The instruments are usually five in number and vary from one-eighth of an inch to an inch in length of operating edge. They are securely bound to reed handles 6 inches in length. Tattooing instruments in the National Museum are mostly from Fiji. The American Indians, by way of contrast, used tattooing needles of sharp flint points or of cactus spines; latterly, steel needles secured firmly in a leather binding.

The points of the tattooing instrument are dipped into candlenut ashes and water, and the instrument is then used to puncture the skin by tapping with a mallet. The rapidity with which the tattooer works in following the pattern marks his skill. Patterns vary from island to island only in minor details which might be called coats of arms to distinguish their people, and each generation had some trifling variation.

Tattooing extends from the waist down to the knee and covers the greater part of the body, but is variegated here and there with neat regular stripes of the untattooed skin. The designs when well oiled appear as silken breeches and caused Behrens of Roggewein's expedition of 1772 to say: "They were clothed from the waist downwards with fringes and a kind of silken stuff artistically wrought." A close inspection would have shown the narrator that the fringes were bunches of ti leaves (*Dracaena terminalis*) glistening with coconut oil, and the silken stuff was the tattooing just described.

When all was ready for the operation the young man would throw himself on the ground. A young woman, generally some relative of the youth being operated upon, sits cross-legged and holds the young man's head in her lap. Three or four girls would hold his legs and sing to drown his groans as he writhed under the lacerations of the instruments. Attendants were present to wipe away the blood as it oozed from the skin. When about as much as one's hand was done, upward of an hour's work, the lad would rise and another would take his place. Each one would have a turn about once a week, depending upon the number in the party.

Payment was made to the tattooers with property consisting of fine mats and native cloth, the value of which depended upon the rank of the young chief being tattooed.

Tattooing is an expensive operation for the one tattooed, though for the operator the rewards for his skill are satisfactory. Food is free to him during the three or four months consumed by the operation. Then, too, the payments in fine mats, in tapa cloths, and other considerations reached a respectable amount. If dissatisfied with the payment offered as the work progressed, the professional tattooer simply delayed his work, as an unfinished tattoo was considered a disgrace. Friends always came to the rescue in such an emergency.

*Headdresses.*—It is impossible to refer to ceremonial garments and decorative wearing apparel without making some slight mention of the ceremony or artistic performance calling for artistic decorative display. Dancing is one of the major methods of expression of Polynesian artistic abilities. Dancing exhibitions are there conducted with the aid of song and the music of instruments. Such performances are designed merely for the entertainment of visitors. The object of the dance is to display native charm and agility. Formerly the Polynesian dance, no doubt, had a symbolical meaning, hinted at by the survival of the punctiliously ceremonial manner in which the simple dance movements are still carried out. The village taupo, or official village mistress of entertainment, is the central figure in the ceremonial dance and is the leader of the concerted movements of the dancers. The dancing group consists of girls working as a ballet. The taupo has undergone a long period of training, and her attendants are rehearsed by her. The excellence of the taupo's dancing and of the ballet is one of the village boasts, and songs and verses of praise are written about it.

The Polynesian dance is very formal. Sometimes three or four hours are required for the toilet of the taupo. Her dress differs from that of her other attendants in one important particular—she wears the tuinga, or Samoan headdress. This headdress is a composite affair of human hair, nautilus shells, plumage, and a scaffold of sticks. It is assembled piece by piece on the wearer's head, and is a source of constant pain to her because of its weight and the tightness with which it is bound onto the head. The foundation is a strip of cloth wound around the head at the roots of the hair. The strip serves to draw the hair into a bunch at the crown and causes it to stand up its full length. Upon the base of real hair is tied a wig of human hair set in a frame of cloth or fiber netting. Then the scaffolding of three sticks and a crosspiece is tied in front and made fast to the cloth covering above the forehead. This framework usually supports a decoration of small mirror disks. Green and red feathers of the tiny parrakeet are attached to the framework, and the tuinga is completed by tying across the forehead a band of several rows of the partition plates of the nautilus. With this

decoration goes a necklace of shells or of whale's teeth ground fine and sharp.

*House furnishings.*—The furnishings of a house are simple. A few bundles of mats, a roll of tapa cloth, and a few household implements and utensils constituted the furniture before the arrival of the Europeans. Now chairs, tables, camphor-wood boxes, and even beds are appearing in their houses. The furnishings are of two sorts: Those cut entirely from wood and those woven or plaited from leaves or bast.

The wooden articles include bowls, cups, tapa beaters, paddles, bamboo head rests, occasionally low wooden seats, and combs. The most prized bowl is the tahoā, used for making kava. There are few of these in any village and they usually belong to the chief's family, or even to the village. The better specimens take years to make and are beautifully shaped, round, smoothly polished, sometimes with a patina of fine color if in long service, and provided with a variable number of legs up to 16 or more. The bowl is made from a single piece of hard-grained heartwood of a large ifilele tree.

Much less care is used in the manufacture of the umete or mixing bowl found in the cook house. It is a shallow oval bowl with a handle at each end.

Tapa beaters or mallets are made of any hardwood, ifilele and toa being especially good for the purpose. They are square in cross section and have a rounded handle. Two surfaces are finely grooved, while two are smooth.

Bamboo head rests consisting of a short length of bamboo with two short spreading legs at each end are being replaced with the more comfortable pillow stuffed with kapok fiber.

Combs of a peculiar pattern were made of hardwood such as the ifilele and toa. Cups are made of coconut shell scraped thin and sometimes carved. Bottles of glass are now used, but coconut shells with a small opening were used, as well as gourds and short lengths of bamboo.

Cotton mosquito nets have almost completely replaced the tapa canopies formerly draped over the beds.

Floor mats are used to cover up the floor of small pebbles. These are coarse mats plaited from the strips of pandanus leaves and paono. The strips vary from 0.12 to 1.25 inches, seldom coarser, the finer usually about one-quarter to one-half an inch in width. The mats are spread on the floor to sit upon, and in piles, the coarser below and the finer above, for a bed. They may be washed and usually are kept clean.

Among the utensils most used are the coarser pack baskets made from the half of a coconut leaf split lengthwise. Food baskets are

made in the same way. The baskets and banana leaves are all the dining-room furniture required, although the natives are beginning to use imported plates and dishes.

Fans are of various shapes and materials. The coarser fans are woven from coconut leaves and are used to fan the spark to produce a flame. The finer fans are used as heat or sun screens for the face.

*Polynesian stone structures and images.*—Spirit houses (Fale-aitu) were erected in some of the districts to the deities, especially the war gods. These temples were built of the same materials and in the same style as the houses of men, with nothing to distinguish them from the ordinary dwelling except that they always stood on platforms of stones varying in height and size with the respect felt for the god. They were usually situated on the public green and surrounded by a low fence. Whatever emblems of the deity were in the possession of the village were placed in the temple.

Worship of a venerated ancestral chief appears in eastern Polynesia, in Easter Island and in Tahiti at its best. It is not so apparent in western Polynesia, in Samoa, and in Tonga. Thus, in Tahiti, the Ahu, or stone-flagged burial quadrangle reserved for the chiefs corresponds to the stone bases on which rest the stone images of Easter Island. They also correspond to the bases on which elsewhere in Polynesia are erected the huts where are preserved the small wooden idols.

In Easter Island the great stone figurines with stone hats are found even on the slopes of the mountains. Elsewhere in Polynesia, in Hawaii, New Zealand, the Marquesas, Hervey Island, even on the borders of Melanesia in Nukumanu, all figurines representing ancestral deities are carved from hardwood. In Easter Island, due to the scarcity of hardwood, the figures of ancestral deities are carved from the tufaceous lava, except for the smaller statuettes of from 1 to 2 feet in length, which are carved from hardwood and are very rare. Characteristic of these smaller figurines is the curved nose, protruding ribs, breastbone in relief, abdomen concave, and thin legs and arms. The hard lavas of Hawaii and of other Polynesian islands and conversely the quantities of hardwood there obtainable led to a distinct development in wood carving in the round.

The Easter Island images are the most interesting of archeological monuments. There are over 600 of them on this island. Formerly they stood in groups of from 6 to 12 on platforms of hewn stone facing the sea, but in later years they have been thrown down during the civil strife among the natives. Most of them are to be found on hillsides at the eastern end of the island. They were hewn out of volcanic tufa in the crater of an extinct volcano and transported over its sides, sometimes 3 or 4 miles, to their destination. The island is

almost treeless, and the wonder is how savages could remove objects so fragile as these, weighing from 3 to 30 tons each, over ground so rugged. There are now 400 people living on the island and they are of pure Polynesian stock. They know nothing whatever of the erection of these images and it is quite evident that they are the descendants of a later immigration. The images exhibited in the National Museum, together with many other objects of ethnological interest, were procured during a 12-day visit to the island in 1886 by the U. S. S. *Mohican*, under Commander B. F. Day, U. S. Navy. (These images are described and illustrated by Paymaster W. J. Thompson, U. S. Navy, in the report of the U. S. National Museum for 1888-89.)

*Artistic ability of the Fijians.*—The skill and artistic ability of the Fijians is shown by type objects exhibited in the National Museum. The exhibit consists of a decorated bark cloth, baskets with pleasing patterns, women's girdles showing remarkable textile work, fans, rolls of coconut fiber cord (sennit); carved wood images, clubs, bowls, food hangers, etc.; masks; and ceremonial fly brushes. The specimens are from the exploring expedition of 1838-1843 under the leadership of Lieutenant Wilkes, U. S. Navy.

The Fiji Islanders have quite fully taken advantage of their material environment and are especially noted for their skill in working wood, from which they make boats, houses, weapons, and a great variety of dishes, headrests, and domestic utensils, which show an appreciation of form and decoration. The exhibit contains carved dishes, pillows, forks, spatulas, coconut-shell cups, and pottery of different shapes, glazed with resin.

In Fiji, painting over of food bowls, kava bowls, pottery, clubs, and other objects is unknown, but the bark-cloth decoration of spaces filled in with figures of black paint resemble the cloth of the Polynesians. It is well known that culturally the Fiji Islanders are closely related to the Tonga and Samoa Islanders. A Melanesian group, the Tami Islanders, are also divergent from ordinary Melanesian practice in that they decorate with carving even the outer surfaces of their wooden bowls and even of their sailing boats. These boats, carrying on commerce with the Siassi Islanders, could readily have absorbed Polynesian decorative ideas so prevalent along the coastal areas of Melanesia. Ordinarily the Melanesians are people of the forested interior or hinterland.

Fiji, which lies on the margin of Polynesia, possessed a greater number and more forms of carved wooden clubs of war and spears than any of the Polynesian islands. The clubs exhibited in the National Museum from Fiji are more massive than those of the dark peoples to the East. The material is usually Polynesian ironwood, which is hard and durable and very difficult to work with primitive tools of stone and shell.



The war spears of the Fiji Islander are made from a single tree trunk under extraordinary difficulties for the worker. They are ornamented with braided coconut fiber cord and carved. One variety has four radiating points lashed to the shaft. The Kingsmill Islander fashions shark-tooth spears and daggers. These weapons are good examples of the skill of these islanders in drilling wood and shark's teeth. Some of the weapons resemble swords. Armor of knotted coconut fiber was used and a helmet of spring fish skin.

Ornaments of the Fijians show an extensive use of shell and much skill in working them into form. The necklaces and other ornaments worked from whale-tooth ivory are remarkable examples of patient industry.

In contrasting the carvings in the round from Melanesia and from Polynesia, one notes at once that the former are painted while Polynesian figurines of hardwood are always unpainted. Furthermore, it is noted that the Melanesian figurines are carved from light wood. There are many accompanying differences in structure and design, also in function.

*Melanesian art.*—In the islands of Melanesia north and east of Australia we find examples of cultural diffusion from two radically distinct ethnic elements—the dark-skinned, kinky-haired Melanese and the wavy-haired, brown-skinned, old Polynesians, who were anciently closely linked with the straight-haired, brown-skinned old Malaysians. Immigrants from Malaysia passed through Melanesia on their way to settle in those islands now known as Polynesia. These old Malaysian immigrants absorbed Melanesian decorative motivation and applied designs after Melanesian patterns to their sculptures in wood, but also distributed early Malaysian design patterns along the coasts of Melanesia, in those islands where they sojourned. This intermixture with Malaysian designs helps to set Melanesian designs apart as distinct from Australian-Papuan decorative designs. To be sure, the old Melanesian art survived, and it is sufficiently distinctive in its elementary manifestations to characterize the entire Melanesian art area as separate from Indonesian or Malaysian art areas.

Melanesia is characterized through the growth of population units more extensive than those of Papua or of Australia, where simple hunters and gatherers lived their nomadic existence. Better houses and a more close-knit social organization grew along with handicrafts and decorative arts. Wood carving in the round served to represent honored and venerated or feared gods and ancestors. These figurines were not painted; at the most, one provided them with decorative textile covering in red colors. This color was considered sacred, although yellow was also used. The nonpainting of sacred ancestral figurines extended as far as Indonesia and Micro-

nesia, along the border of the Melanesian-Papuan land masses, such as Kaniot in the west and Sikaiana and Loaniua in the east. Tattooing, for example, was not taken up by the people of dark skins, who used instead an abundance of paint, which, in turn, was not used by the lighter-skinned Indonesians who tattooed themselves. The coasts of all Melanesian islands, inclusive of New Guinea, have become Malayan in culture and decorative art. The painting of bark cloth, which appears to best advantage in Polynesia, occurs but seldom in Indonesian and Micronesian art, as in Celebes, for example, where painted bark cloth substitutes for woven rectangular matting.

The Polynesians fashioned their hardwood gods in artistic manner and saw no need to paint them, while the Melanesians fashioned their gods of softer woods in sketchy manner and painted them with gaudy colors. These gods served them only for the festival period. Throughout entire Melanesia there is a riot of color painting, excepting such wooden vessels as are fashioned on the Admiralty Islands, which are not painted.

The carved and tied objects of New Ireland, designed for the cult of the dead, namely the large helmeted heads with small body and yet smaller legs, are similar to the sculptured figurines of Raratonga and New Zealand. In all these figures the painting of the face is similar. This is replaced by the Maori with tattooing. The Uli figures of New Zealand (dead cult) show breasts and phallus—a sort of a fertility fetish similar to that of India. The Uli figure is also somewhat similar to the New Guinea ancestral figurines from the Sepik River tribes, and even resembles the wooden idols of the Maori and of the ancient Easter Islanders, apparent in the rib structure revealed on the New Guinea and Easter Island figures. Papuan influence may be seen in the ray-like appendages on the body sculptures of idols from the Tugeri of the south coast of New Guinea, also on the plastic puppets which are occasionally provided with wooden masks. These wooden figurines are found also in the New Hebrides, in New Guinea, in the Admiralty and Solomon Islands. The Solomon Island puppets have black heads inset with mother of pearl and the Sepik River type is like the bill of a bird. Squatting figures, strangely reminiscent of the Sepik type and of those of the island of Bali, also occur.

The bird motive in Melanesian religious art design goes back to their mythology and is similar to Indian religious art. Thus the bird motive is present not only in figurines but in shield decoration and in symbolism from New Guinea, particularly the ancestral images with bird beak and red paint, and stylized incised border designs, otherwise apparently foreign to the Australian-Papuan and the purely Polynesian art motivation. One finds it in west New

Guinea, where the Melanesian-Papuan element meets with the Indonesian art motivation especially characterized in the squatting figures used as burial vaults, again on the neck rests, wooden carved drums, shields, spears, and bamboo lime containers of the north and south coasts. These display in part the bordered incised designs, in part the faces and figures of men and animals in abundance of decorative variation, all this carving in the round and etching on wood being the work of practically naked cannibals. In the Sepik figurines of carved wood the nose becomes a beak extending to the navel as an ornamental embellishment. This may be due to bird mythology and to nose piercing which distorts the septum of the nose in real life in a supposedly ornamental manner. Ornamental designs of a crocodile head from the Sepik is pleasing and realistic, not grotesque as are the above mentioned. In the south of New Guinea the Tugeri, also the tribes on the Gulf of Papua, all possess this ability of pleasing animal sculpture.

In the east of the island, in the Massim region, appears Indonesian art decoration. This is seen also in the Solomons, where decorated bamboo lime boxes similar to those from Timor in highly ornamental patterns appear, along with dancing boards, black bowls with mother of pearl inlay and horseshoe-shape patterns.

*Aboriginal Australian design.*—When separated from their traditional methods of executing art designs, most primitive peoples make a poor showing. A conventionalized frigate bird, spiral, or a water buffalo volute may be practically mathematically perfect when it leaves the hand of the Polynesian or Malayan artist, but actual pictures of the frigate bird or of the water buffalo could not be drawn by either of the two. Apparently we must go back to the less sophisticated Magdalenian of the old stone age, or the bushman, or even the lowly Australian aborigine, for realism in pictographic art. Smooth surfaces of rock boulders and cliffs are sometimes covered with paintings of hunting scenes, human faces, corroboree scenes, and of animal life. Melanesians are also skillful in pictographic art. The work of Australian and of Melanesian, also of African bushmen artists, like that of the Eskimo, is in silhouette and lacks perspective.

Australia, larger than continental United States and bordering Indonesia on the south, shows but little differentiation in art designs, and these but of a low grade, on a par with those of the South African bushmen and kindred tribes. Museum collections representing the tribal art characteristic of north, south, and west Australia, include totemic designs on incised stone, bone, and wood. Their representations in sand pictures are considered superior to their incised work on stone and wood. Ornaments of fur and feathers are common; paint designs are associated with incised shell and other media. In art, as in several other phases of primitive life, Australian

aboriginal art is inferior to that of other peoples who have a similarly developed totemic system.

The Australians are one of the most primitive of peoples, and their exhibit at the National Museum consists of spear hurlers, boomerangs, clubs, stone axes, shields, an ornamented fur robe, a netted bag, baskets, a message stick, and a pair of shoes which are thought to render the wearer invisible. Their boomerangs, churingas, and message sticks have symmetrically incised or painted designs.

Isolated as are the great island masses of New Guinea and Australia, we find, as expected, that the decorative motives and the style of their application are distinctive and extremely stylized. A further causative factor in emphasizing the isolation of their art impulses is the racial integrity combined with linguistic forces peculiar to the area. The patterns are applied to basketry and to wood through painted designs. Another form is the combined incised and painted design so frequently found on Melanesian weapons of offense and defense. Sand paintings of a ceremonial nature are not nearly so pleasing as are those of the Hopi of southwestern United States; they are rather in form of a maze such as is well known to our Apache artist when in a ceremonial mood.

Painting with carbon or charcoal or colored clay is also characteristic principally in red and yellow earths. The body is thus painted with stripes; line drawings, and flat surfaces forming geometrical figures. Even the rocks are thus painted, as are objects of diverse description. The narrow oblong wooden shield and the wooden troughlike bowls are so painted, the latter being longitudinally corrugated and painted over with red ochre. Further ornamentation is in the form of white and black bands. Weapons, as shields, spears, and spear-throwers, have zigzag line ornamentation representing snakes. Transverse line, angle, and flat surface designs are varied, and on the curved wooden boomerangs are wavy V-shape patterns in transverse order.

In North Australia basketry ornamentation occasionally takes on a realistic spirit in the form of painted dancer or warrior figures. Peoples having a higher development of basketry technology weave their decorative designs in the body walls of the basket, so that both in the primitive design itself and in the technical deficiencies of basketry, for instance, may one see the low stage of Australian culture. To be sure many peoples, as our own Plains Indians and the Malayan peoples of Java and the Philippines, have a highly developed technical achievement—the one in quill work and the other in basketry—but a corresponding lack of development of pictographic or painting art. It is impossible to establish from observation the art sequence of peoples, whether one observes the Papuans and the

Australians, among whom the art of painting is developed but plastic efforts are crude or entirely lacking, or whether one considers Malay groups among whom the weaver's art and plastic efforts generally reach a high stage but who can not paint. On the basis of such comparisons it is impossible to determine which art is the older. It is rather true that they are mutually exclusive in principle. We need but refer to the crude pictographic efforts of Polynesia, where a corresponding pictographic art—that of tattooing—is highly developed. The modeling of human or animal figures is almost absent in Australia, while the churingas of stone are so carved in the round as to be work of pleasing artistic merit. These highly conventionalized devices, representative of their god or totem, are intimately associated with mythological religious lore and represent imaginary personalities showing a well-understood conventional art. Churingas are usually oval or flat pieces of stone or wood and are provided with incised and painted decorative designs. It is said that the peculiar lengthwise corrugations are first cut into the surfaces of a wood churinga or shield piece to better hold the applied red ochre paint. Patterns are mostly wavy lines or broken circles and spirals usually in connected series. Originally these figures, like conventionalized devices on California Indian basketry, had a symbolical meaning and were not to be considered as purely decorative. Concentric circles are designated as rest places, while diverging lines are trails taking on forms of the maze.

Among the Australians, who are hunters primarily, animal souls must either be appeased or intimidated. Thus arise scenic art portraying the methods whereby this is effected in a conventional manner. From another angle this highly stylized art might be viewed as a form of pictographic writing in the form of a primitive map or plat as viewed from above. An opossum churinga, for instance, on which incised and painted lines appear, represent, as mentioned, trails and hiding places, while star forms represent trees about which the game animal moves. The whole thus appears as a hunter's charm accessory.

At times a wavy line appears to represent a trail, again a snake, a grub or worm, a vine, however the technical ability to realistically portray is lacking. When a useful article, as a churinga of a shield, has etched or painted devices not much more intelligible than childish efforts it must not be understood that they are therefore meaningless. The primitive artist feels that decoration enhances the value and effectiveness of the object. The dance, the battle, and the hunt are primary activities in the life of the primitive Australian, but nowhere do the Australians approach the excellent drawings of the bushmen of South Africa.

*Papua and New Guinea.*—The desire for ornament is very marked among the dark-skinned islanders of Papua and Melanesia. The specimens exhibited in the National Museum from New Guinea consist of costumes of fiber, arm and neck ornaments of feathers, shells, teeth, weapons, basketry, etc.; headdress, combs; carved wood spatulas, decorated gourd and bamboo vessels, etc. There are also shown wood carvings from the Solomon Islands. The recent explorations of Stirling in the interior of Dutch New Guinea, and of Brandes in British New Guinea and the territory of Papua in the east, have given the Museum a most extensive and representative Papuan and Negrito collection, while the great collections from Malaysia obtained by W. L. Abbott can perhaps never be duplicated.

It appears that in Oceania geometrical designs are almost always traceable to some anthropomorphic or zoomorphic or phyllomorphic motive more or less conventionalized. Thus in the bark belts collected by Abbott and Brandes the human face has been applied as a decorative pattern. Eye forms are occasionally plainly recognizable. On combs and wooden clubs are etched the curved beak and eye of the frigate bird. This design is conventionally modified into meandered interlocking spirals with the eye placed at each point of intersection. The beak alone is represented occasionally in Melanesian art as scrolled arabesques.

The Papuan tribes excel the Australians in the plastic modeling of human and animal forms in a peculiar manner. A framework is constructed, covered with bark and painted white. Masks are so constructed and are rather terrible examples of realism in the form of masks and headdresses of heroic size. Such huge masks are supported by attendants holding bamboo staves, and have therefore little ornamental and art value. Painted lines and angles and a host of smaller devices in color fill in the facial planes, which are done in unconventional manner or free style. In New Guinea the more realistic efforts, which, as mentioned, are quite lacking in Australia, occur in typical Papuan painted form. The origin of this art must lie in the proximity of the Sulka and other coastal Papuan tribes in contact with old Malayan art.

*Negritos and Papuans of central Dutch New Guinea.*—The recent Stirling-Smithsonian expedition to the highlands of central Dutch New Guinea, under the leadership of Matthew W. Stirling, has achieved some striking and important results. Negrito groups of the Nassau Mountains, hitherto unvisited by white men, and Papuans of the central lake plain, which lies between the Nassau Mountains on the south and the Van Rees Mountains on the north, are now made known to science for the first time.

Stirling found the Negrito, a negrillo pygmy people, in possession of a sedentary, comparatively high culture based on agriculture, on the one hand far outranking neighboring Papuan peoples while offering in almost every respect a marked contrast culturally to the physically related groups of Malaysia. Characteristic of the Negrito or negrillo pygmies throughout the range of their distribution, notably in the interior of the Malay Peninsula, in the Philippines, and in the Andaman Islands, is their isolated habitat, which is usually a mountainous more or less inaccessible interior plateau region where they are surrounded entirely by stronger and more numerous lowland peoples. Characteristic of the Negrito of central New Guinea is the diminutive stature, which in males is less than 152 centimeters, in females 145 centimeters, and the dark skin color and frizzy black hair. Stirling found several individual Negritos of the Nassau Mountains with hair of a reddish tinge. The Negritos of the Upper Rouffaer River valley were found in possession of a well-developed economic system based on agriculture, but with no governmental organization extending beyond the isolated villages. It becomes necessary, as a result of the discoveries of the expedition, to enlarge our conception regarding the commonly attributed cultural characteristics of the Negrito.

The pygmy Negrito of the Nassau Mountains lives in a region inaccessible alike to hostile Papuan and to the white race. There they have developed a culture unique to science, differing in many respects from that of the Papuans and from Negrito tribes living elsewhere. Stirling found wide variations in the language spoken by different pygmy Negrito groups. Just what this variation signifies will be indicated after further study. Whether all of the observed linguistic differences will prove to be variants of existing Papuan stock languages, presenting a condition similar to that prevailing in the Philippine Islands, where Negrito spoken language has been revealed as variant of the Malayan stock language, or whether there may be different languages existing among the New Guinea Negritos themselves will undoubtedly be established after Mr. Stirling has made a thorough study of the linguistic data obtained.

Animistic tendencies were noted in the observation that the Negrito believes spirits of dead relatives to inhabit various natural objects, such as stones and water, also different kinds of animals. Another observation of considerable interest is that the Papuan groups do not bury their dead, but instead leave the bodies exposed near the villages, producing a condition which does not tend to enhance the pleasure of sojourning in the vicinity. A gruesome ornamental

pendant worn by Papuans suspended from the girdle consists of the mandible (lower jawbone) of some departed ancestor or other relative snatched from the putrefying body. After the flesh has been scraped away a fabric band is woven around the central part of the mandible and a suspension loop attached. Two of these amuletic pendants from the Kirakai River are included in the collection brought back by the expedition. Negritos bury their dead according to a ritual, and so offer another testimony of the superiority of their culture over that of the Papuan.

It is in his material culture and decorative art designs that the peculiar development of the Negrito is best demonstrated. Houses are erected of rough-hewn wooden slabs set vertically and covered over with grass and palm-leaf thatch. The flooring of rough-hewn boards is placed several inches above the ground. This is probably a culture survival, as there appears to be no need for this custom, either as a protective or sanitary measure, in the salubrious uplands of the Nassau Mountains. Decorative art is manifest principally in surface patterns on weapons.

Clearings are perched on precarious slopes of the steep mountain sides. Various crops are produced. A variety of white sweetpotato, sago, taro roots, sugarcane, bananas, tobacco, and lemons are staple products. The use of potatoes and of starchy food in general is preponderant in the diet of the Negrito and causes an unusual distension of the stomach and abdominal region. An oblong wooden food dish is cut out of the solid trunk of a certain soft-textured tree. These food dishes are two or more feet in length and are used somewhat as mixing bowls or as mealing stones, no stone mortar being employed.

Spoons, awls, dirks, weaving and plaiting implements, and various other objects are fashioned into implements for daily domestic use from leg and wing bones of birds, chiefly from the tibiae of the cassowary, a tall and somewhat vicious bird inhabiting all sections of the island. By far the greater use of bone is in the fashioning of ornamental objects, charms, and trophies. Here, again, there is an observable distinction between the primitive technology of the Negrito and the Papuan. The marked tendency of the Negrito is in the direction of simplicity of construction or meagerness of application and is linked with excellent technique and artistic merit in ornamental designs introduced. The Papuan displays a lavish use of materials combined with a coarseness of technique and a quite elementary art impulse and execution of design.

A food cooker like that of the Polynesians is used by the Negrito. A depression is made in the ground and is lined with stones. In this cavity are placed food ingredients, such as meat, potatoes, or



taro. Hot cooking stones wrapped in leaves are then placed on the food and the whole is covered over with ashes and earth. Exclusion of air serves to continue the cooking process for some time. Thus is created a primitive fireless cooker.

There is scarcity of domestic implements but a great variety of woven cord fabrics, applied chiefly to the making of openwork weave meshed carrying, storage, and trophy bags. Although very few and crude baskets are made by the Negrito, basketry materials and technique are applied as in the making of body armor, in ornamental braided bands resembling the continuous braided bands of basketry materials so much in vogue among the peoples of Malaysia, in the braided thong woven as wristlets, in headbands and ornamental wristlets of twill weave, and in many other objects betraying a skill that could easily have been applied to the making of baskets as well.

Pottery making, like the use of metals, is unknown to Papuans and pygmy Negritos alike.

As no cradle board is employed, carrying bags of woven cord fabric are used. Such a carrying bag is often quite large. It is woven with a 2-ply cord fabric in simple openwork meshed design and may be used to carry everything from firewood, meat, potatoes, and other supplies, along with a baby unceremoniously thrust into its improvised cradle, from which it is removed without protest on the return of the mother from the clearing.

Many of the woven carrying bags have an ornamental figured design covering one side effected through the introduction of peeled grommets from the yellow stems of the orchid. Some of these are stained a dull red, producing with the natural color of the fabric material designs in three colors. The designs introduced form geometric rectangular figures and are produced by intertwining the introduced peeled orchid strips with the 2-ply fabric of which the bag is made. Peeled strips of yellow orchid stems are similarly introduced as appliqué designs on charm and trophy bags, also on girdles and other objects of personal adornment. Cut sections of stems of orchid are mounted on fabric cord as beaded necklaces.

The carrying bag is worn as a headdress when not in use for other purposes, a portion of it being allowed to drop like a veil at the side of the head or down the back. This draping lends a peculiar appearance to the wearer, giving the Negrito the illusory appearance of having a Semitic cast of facial and head features. When in use as a carrier, a long band or tump line, with which it is provided, is passed around and over the forehead.

Another variety of meshed bag, the so-called trophy bag, is worn by men only. It is carried under the armpit at one side of the body and is supported over the opposite shoulder. Attached to this bag

are ornamental appendages of boar's tusks, each tusk representing a trophy of the hunt. The Negrito uses no spear but bags his game with the aid of his dogs and his bow and arrows only. There is nothing remarkable about the bow. It is formed from the black palmwood, is 5 or 6 feet in length and is plain, the ensemble of bow and bamboo arrow resembling for the most part the bow and arrow used by the Tinguian of Luzon.

One peculiarity in the construction of the Negrito hunting or trophy bags is in the attachment of a neatly carved and highly polished "swagger stick" of bone cut from a tibia of the cassowary. It is secured by a wooden pivot, around which the "stick" is almost constantly twirled by the Negrito hunter when he is not otherwise occupied. A small wooden pillow 6 or 8 inches long and 3 or 4 inches wide, but less than one-half inch in thickness, is always carried in the trophy bag.

A third type of woven fabric bag is the smaller charm or amulet bag of similar weave and ornamented profusely with peeled orchid bark. The charm bag represents, along with the woven body armor, some of the finest products of the skill of the Negrito in the loomless handicrafts. It is a small pouch 3 or 4 inches long, scarcely large enough to carry a tooth, a beautifully colored seed, or some other similar amulet. The compact weave is dissimilar to that of the large open-mesh bags. It is a combination of a series of braided ribs, each having two or three elements and each made up of 2-ply cord. These braided ribs are passed diagonally from one side of the bag to the other and have no connection with each other except at the center of the bag, which on completion becomes the bottom, and at each end where the braided rib terminates by having each one of its constituent elements become an element in the next braided rib. By arranging the braided ribs about a center near each end of the bag, and having the ribs terminated there, the bag assumes an oblong rectangular outline. A novel feature is introduced at this stage in the making of the charm bag. On the surface which is to become the outer one, a continuous strip of peeled bark of the orchid is twined longitudinally around each intersecting braided rib with which it forms an X-shape angle firmly knitting the different ribs together and at the same time supplying a beautiful ornamental pattern. So far as is known this weave is new to science. A braided rib representing the elements taken from four of the braided ribs of the bag thus continued forms an extension several inches in length. This is designed for a cover, as each charm bag represented in the collection has an extension cord just long enough to be passed enough times around the bag to completely inclose it if the process is begun at one end and continued to the opposite end of the bag.

The clothing of the pygmy Negrito is scanty. Women wear a skirt girdle of braided cord with cord fringes 3 to 6 inches in length, or of plaited pandanus palm leaves. The girdle worn by the Negrito men is even more scanty but is more picturesque. Here, again, are used the grommets of peeled bark of the orchid as an ornamental surface design, strands of which are intertwined with the other fabric elements, making up that portion of the girdle 6 to 10 inches in length fitted to the small of the back, where it is passed back and forth until the desired thickness is obtained. As the girdle braid is of the thickness of one-third inch 15 to 25 thicknesses are used to form the desired thickness for the back pad or bustle, as one may choose to call it. Looped about this pad at either end is a coarse double strand of fabric cord passing around the body where one end is attached to a small braided basketry band about 2 centimeters wide and of large enough a diameter to be fitted over a slender, tapered gourd used as a penis cap. The other end of the gourd girdle, which is passed about the body from the opposite side, terminates in a knot. This knot is slipped under the basketry band and the band is pushed downward on the expanding side walls of the gourd until it is firmly fixed. This completes the men's costume, except for the headdress and body armor.

The Papuan male costume includes two elements worthy of note. These are the taillike ornaments of cassowary feathers or of pandanus palm leaves and the sharp-pointed nose ornaments of bone which are passed through the nostril wings both vertically and horizontally. The taillike ornament affected by the Papuan consists of a number of pandanus leaves or of the tail feathers of the cassowary attached to the end of a short curved stick of wood slit open at one end for insertion of the plume and curved at the other end for insertion in the girdle. Mr. Stirling states that the Papuan feels himself quite undressed when he is without his tail ornament and that he would take to the bush immediately after having parted with this so necessary article of personal adornment to members of the expedition for a consideration, to the great amusement of his fellows.

Among the various kinds of headbands and headdresses in use among the Negritos and Papuans is a simple twill weave, delicately plaited headband of rattan, ranging in width from 1 to 2 inches. Another headdress worn by the Negritos is one of coiled cassowary feathers attached to a woven basketry frame of rattan splines. Still another consists of a woven band of basketry material with inset of shell, plumed pompons of bird of paradise feathers, and others of feathers resembling those of the Carib Indians of Vene-

zuela and Guiana. Sometimes a bit of crimson color is obtained by addition of tail coverts of small birds of brilliant hue.

Wristlets of coarse braided rattan, which are also used as fire thongs, or of more finely woven braided bands of fine basketry material, and others, stained to form geometric designs, complete the costume; though many additional touches are lent by ornamental necklaces of variously colored seeds, shell, and beads from cut section of orchid stems.

A characteristic object from the Papuans of the Kirakai and mid-Rouffaer Rivers is a trophy bag carried by the Papuans in much the same manner as the Negrito carries his trophy bag, to which, however, it is far inferior. This trophy bag seems to have a certain value as a charm and the essential ornamental features, chiefly pendants of the crudest kind, occur also as pendants on amuletic necklaces worn by Papuan women of the central plain. The pendants are trophies of the hunt, as cassowary bird heads, beaks of hornbill, feet of bird of paradise, leg bones of various birds, pig tails, and snake tails. All of these are attached at the side of the rather compactly twined woven bag with loops of rattan splints, the ends of which are inserted between skin and bone of the leg and tail piece pendants. Shrinkage due to drying causes the rattan loops to remain firmly fixed. The amuletic necklaces worn by Papuan women have still other pendants attached, such as fragments of bird bodies, seeds of the common allspice, sections of bone and shell, together with bits of bark.

One of the more characteristic methods of executing ornamental designs employed by Papuans is the etching of surface designs on arrow points. These designs are so highly differentiated as to easily distinguish one area from another and also from the designs executed by Negritos on their bamboo arrow points. The latter are characterized by wrappings of peeled grommets of orchid stems. Papuan designs are applied both to bamboo shaft and bamboo or palm-wood foreshaft and may take the form either of curvilinear or rectilinear surface etchings or of carvings on the body of the foreshaft. Inlay of lime or white paint is sometimes applied on carved surfaces in true Melanesian style.

A peculiarity of the Negrito arrow from the Upper Rouffaer Valley is the banded ferrule which is placed over the juncture of palm-wood foreshaft with bamboo shaft. This small woven ferrule with its unique spiny surface, due to the peculiar twined weave, is identical with the ferrule made by the Negrito in the Philippine Islands and which is used by them for a similar function. This is the only deep-seated resemblance noted in the weapons of these widely separated pygmy groups, unless one takes into consideration

the nonuse of the blowgun by each. Culture characteristics of each resemble more the culture complex of adjoining peoples than that of a common ancestry.

The Takutamesa Papuans have shafted arrows of bamboo with heads of leaf-shape split sections of bamboo stem. Line etchings on arrow head and bamboo shaft probably represent animal figures.

The Van der Willigen Papuan arrow type has but few line etchings on its bamboo shaft but has elaborate barbing carved bilaterally on its palm-wood foreshaft. A peculiarity noted is the reverse feathering attached to foreshaft at the tip. The base of quill is pointed toward the nock while the tip of feather is near the tip of the arrow point.

Arrows from the Papuans of the Upper Mamberamo River are as a rule tipped with bone, a diagonal section of which has been removed to form a point. Etched lines occur both on bone point and bamboo shaft. The foreshaft is of palm wood, is triangular in section, and is deeply barbed in pairs along two of the intersecting angles but not along the third.

Arrows obtained at the junction of the Van Daalen and Rouffaer Rivers are tipped with a cut section of bone. One of the arrows has an unusually long foreshaft of palm wood with many diagonally cut sunken panels which provides a jagged surface for lacerating and making large wounds.

The Sebit Papuans of the Upper Mamberamo River Valley etch an ornamental design on their bamboo arrow shafts by burning banded lines around the circumference of shaft, also by etching curvilinear figures representing animal forms. The foreshaft is multiple barbed and bone tipped.

The Papuans of the Kirakai River have arrows with bamboo shafts. Some of the foreshafts of palm wood are unusual in that they have multiple trilateral barbs placed at lines of intersection of the triangular sectioned foreshaft.

Papuans of the Lower Rouffaer River make, in addition to the burned-etched banded designs used by the Sebit Papuans, peculiar long dashlike punctated figures by burning. A leaf-shaped section of bamboo stem is the usual form of arrowhead and usual material employed by Papuans and Negritos alike. The sole exception is the bone-tipped palm-wood point which is also foreshaft and occurs in about 30 per cent of all Papuan arrows. It is not used by the Negritos.

Bows are of uniform type and are inferior to the arrows from the viewpoints of artistic design, craftsmanship, and inventiveness displayed in their construction. They are long, straight, flat surfaced on the inner and rounded on the outer side. The bow cord is a long

strip of rattan knotted at each end and easily slipped over the slightly hollowed nock ends of the bow.

Fishing is conducted with circular dip nets held in the hand. Other forms of fishing paraphernalia include long funnel-like traps of rattan splints. Similarly shaped traps made from some unidentified thorny vine are used by Papuans of the Kirakai River region.

A form of body armor appears as an enlarged girdle among the Takutamesa and Sebit Papuans of the Van Rees Mountains. It consists of a narrow braided band made from an unidentified vegetable fiber which is wrapped around the abdomen from 75 to 150 times, forming a bulging roll completely covering the lower torso. The nearest resemblance to this object of wearing apparel, which is both ornamental and protective, is the braided girdle worn by the Igorot.

True armor appears in use among the pygmy Negritos. The Negritos of New Guinea are alone among all pygmy Negrito peoples in their use of body armor. The armor appears in the form of a woven fabric jacket which is worn as a covering over the chest and lower abdomen. The armor shows not only high artistic merit but embodies the principles of extreme flexibility and durability. Native arrows can not penetrate it except at the top, where it is suspended from the shoulders by straps of woven fabric which also cover the upper chest. The armor proper begins with a change in the weave at a line 3 or 4 inches below the shoulder straps. The weave from this line downward is a compact form of a double-faced twisted-twine pattern. It appears to be new to science and an exceedingly ingenious invention. As the Negrito's life depends on the strength and impenetrability of his body armor, no shields being used, it may be understood that the weaving of body armor represents his best efforts and skill as a weaver. The warp or passive element is made of a continuous strand of rattan splints which passes vertically from top to bottom and back again entirely around the circumference of the jacket. The crossed weft or active element, also of finely cut rattan splints, passes horizontally across the body as a twisted twined element. The unique features of this weave, which supplies flexibility and strength, may be seen in the manner in which the weft is twined first over two warp elements, then completely around the second, and again over two but undergoing two twists in the process. The same process is carried forward on the reverse side of the jacket, forming identical patterns on both inner and outer surfaces and supplying great toughness of fabric.

The ribbed weave of the upper portion of the jacket is similar to that described before when discussing the weave pattern of the Negrito charm bags. Peeled grommets of orchid stems are intro-

duced to produce ornamental patterns as in the charm bags. Across the front of the jacket where the true armor weave begins is a line of ornamental display of feather decorations, chiefly from the tail feathers of the bird of paradise.

Tobacco and narcotics are in general use among the sedentary pygmy Negritos of the Upper Rouffaer River area. Mr. Stirling observed infants in arms smoking cigarettes which were offered them by their mothers and nurses. The container in which the cigarette is wrapped is the leaf of the pandanus palm, a supply of which is carried in small tubes made from sections of bamboo stems and carried in the lobe of the ear. Curvilinear and rectilinear designs made by burning are etched on the surfaces of these containers. Tobacco is usually smoked in pipes fashioned either from a tree knot or from an unidentified variety of unusually large acorn. The oak grows in abundance along the Middle and Upper Rouffaer River. To the base of the hollowed pipe bowl there is affixed a short section of stem of orchid ferruled with pitch or wrapped with cord. In two instances the ferrule is an excellent example of continuous braided band similar to that attached to arrow shafts. Tobacco was introduced evidently at an early date and is now cultivated in the community plot in the center of the village, where are also grown all of the other plant products and vegetables. The development of agriculture and the domestication of animals by the Negrito is his own achievement, probably developed on the spot, and not an importation. With but one or two exceptions there seems to be no trace of cultural relationship with the physically related pygmy stocks elsewhere, so that linguistic data obtained by the expedition becomes exceedingly important.

*The Andamanese.*—The Andamanese likewise are a very primitive people. No satisfactory explanation has yet been made of the large number of exceedingly primitive peoples occupying the coastal fringe of Asia and the mountainous interior of the East Indies. In almost every case these primitive peoples are negroid, diminutive in stature, and distinct physically from the higher cultural peoples forming the bulk of the insular population. Such people, of which the Andamanese are typical, support themselves almost entirely by hunting and fishing. Use of clothing is but poorly developed. As among all negroid peoples with dark skins, a peculiar form of body decoration is practiced by the Andamanese. Tattooing would not be effective, unless some form of white color design could be introduced. This is not done by any known tribe. On the other hand, a bringing into relief of certain parts of the skin is effected wherever elementary ornamental designs are produced. This bruising or scarring of the body is known as cicatrization.

The Andamanese, too, live in constant fear of demons. In such repressive environment art forms can scarcely develop into styles of art. A peculiar form of ancestor veneration may be noted among the Andamanese in common with primitive peoples elsewhere in the island world of southeastern Asia. Necklaces are made of the bones of dead relatives. Even the skull of a friend or relative is decorated and worn as a pendant. A strange coincidence is the presence of a similar custom reaching their somewhat similar stage of development in the island of New Guinea. As opposed to the use of cicatrization on the part of the dark-skinned primitive peoples, the yellow-skinned peoples of southeastern Asia and of Oceania generally tattooed their faces and bodies. Frequently such designs are symbolical; mostly, however, they are purely decorative. Some are emblematic, showing that the one so marked has achieved majority and is now a full-fledged member of the tribe.

The Andamanese and the Negritos, the one living north of Sumatra on a small island group in the Bay of Bengal, and the other in the heart of the Malay country in the interior of the Philippine Archipelago, in Borneo, and in central New Guinea, live like the Australians, under primitive housing conditions, merely a wind shelter. Being nomadic, they accumulate but little by way of a material culture suitable for application for art designs. The Andamanese have been but little affected by foreign influence, partly due to their isolation and to their reputation as fighters and due to their linguistic isolation. But little similarity with Australians may be noted aside from their negroid affiliations, bodily decoration, and the painting of their ornamented objects in red ochre. These may be of practical use or cult objects. Either realism or geometric art patterns are present, however, in minute quantities. It is difficult to include such widely separated peoples as the Negritos, the Andamanese, and the Australian in one art area, although sharing alike in the crudity of their art devices and to some extent in the technic of their application.

*The Nicobarese.*—If we follow the chain of islands connecting the Asiatic mainland with the larger islands of Malaysia we encounter the Nicobar group, which lies off the Malay Peninsula. The people occupying the Nicobar Islands are apparently distinct from the inhabitants of another small island group in the vicinity of the Andamanese. This primitive tribe has quite a developed art complex and ornaments of several descriptions might be mentioned, such as cylindrical ear plugs of wood. They have also developed a technic of painting figures and figurines on wooden boards. This is perhaps a form of mnemonic writing somewhat similar to the pictographs used in the time counts of the Chippewa Indians. As among the Sinhalese, art is made subservient to the needs of primitive religion.



The entire gamut of artistic expression is applied to the shaping of devices to scare away the demons.

*Sinhalese art.*—The large island of Ceylon, just off the southeastern coast of India, through the Sinhalese has developed a rather decorative style of art. This may be traced to Brahmanistic and Buddhistic religious influences from India, and the more ancient primitive native religion of the Sinhalese. The so-called devil worship of the Sinhalese reaches an expression in art through the use of grotesque wooden masks, representing for the most part major and minor demons. As in northwestern North America, masks are the accessories of the shaman, and each mask represents one kind of disease. In the Museum collection from Ceylon are several Ceylonese masks.

*Elementary decorative art of the Veddah.*—Another primitive tribe in Ceylon, the Veddahs, are apparently related to the primitive peoples in the Malaysian Peninsula, the Sakai, perhaps also to the Negrito and black peoples of Indonesia. These peoples apparently are almost devoid of artistic expression through the means of decorative art. In fact not even bodily decorations are practiced, such as scarifications, or even the piercing of the ears for earrings. The same might be said for other primitive tribes in the interior of the islands of Malaysia and Indonesia, except that for each of them a few objects of ornamental art are known, such as wristlets, leg bandages, necklaces, and other rudimentary forms of decorative art.

*Cultural affiliations in Indonesia.*—No region of the earth is so isolated as Australia and New Guinea, while none is so rich in types, so articulated, and so hybridized as Indonesia.

Indonesia lies at the boundary of South Asia, facing on the one hand Micronesia, on another, Melanesia, and on still another New Guinea. It fronts southeastern Asia as a compact-land mass, and has sent out a tentacle as far as the southeastern coast of Africa, i. e., Madagascar.

It is not attempted in this article to discuss art styles of the several cultural areas of Asia, although a cradleland, so to speak, of insular art styles as found in Indonesia, particularly the Malayan islands of Java, Borneo, and the Philippines. Then, too, the environmental influences of diverse geographical regions of Asia have tended to make for dissimilar art forms and styles. Prevalent use of rattan and bamboo in the insular world off the southwestern coast of Asia likewise has introduced a central motive in Indonesian art that is not found on the mainland.

The Japanese, perhaps more than any modern insular Asiatic people, can trace their art to a direct continental source, but there, too, we find a great divergence from Chinese prototypes. Asia

is the traditional home of the world's great historical religions, the religious art of which has penetrated the entire world wherever Asiatic influence has at all made itself felt. Perhaps the greatest of these influences may be traced to Buddhism in Indonesia. This has made itself felt through the several invasions and migrations which may be traced direct to India.

Biologically and geologically Indonesia is divided according to its relationship with the continental land masses of Asia or Australia. The dividing line is the narrow water passage between Bali and Lombok, two small islands of the southern East Indian Archipelago, and the contiguous Strait of Macassar. The great islands of Sumatra, Java, and Borneo were formerly joined with the continent of Asia, while Celebes, the Moluccas, and New Guinea at one time were a part of the Australian Continent. Animals of the Asiatic mainland, such as the tapir, tiger, rhinoceros, and elephant, are found in Sumatra and Java, while marsupials, such as the cuscus and birds of paradise, are indigenous to New Guinea and Australia.

Borneo and other great islands of the East Indies, as Java, Celebes, and the Philippines, are populated primarily by Asiatic species, although the great animals of Sumatra, as the tiger and elephant, are not represented. The people occupying these islands are decidedly related to the southern Mongoloid group. Their speech is Malayan, and their culture has been repeatedly influenced from Asiatic sources. In thus classifying the population, one must disregard the minority, which is negroid and a somewhat protean population element. In the eastern half of Indonesia, black-skinned, broad-nosed, and wavy or kinky-haired Melanesians and Papuans far outnumber the Malay element, which alone is the indigenous population. The very name Melanesian characterizes the area as the home of a black-skinned race. These negroids of the Malay Peninsula, Andaman Islands, Borneo, Sumatra, and the Philippine Islands, are not identical with the New Guinea and Australian blacks but are loosely related culturally to Malayan tribes of surrounding areas.

*Malayan decorative art.*—When the island archipelagos of the East Indies were first occupied by the Indonesian immigrants they found them settled by a primitive Negrito stock. These aborigines retreated into the interiors of the larger islands perhaps without attempting contact with the Indonesian invaders. They consequently left but little, if any, mark on the decorative art of the Malayan immigrants. These new occupants of the East Indies have been called Indonesians, Old Malaysans, even Old Polynesians. In the Philippine Islands their descendants are clearly distinguishable from the more recent Malays who have everywhere been much influenced by Mohammedan and the earlier Buddhist and Hindu religious cult

**art.** The non-Mohammedan tribes of the Philippine Islands, added to the non-Christian tribes, correspond to what might there be called the early Indonesian elements. The hill tribes of Luzon, the so-called Igorots, and of Mindanao are the most important. In East Borneo, in Metwi Island, and in Timor also are found tribes possessing decorative designs typical of what we might call early Malayan or Indonesian art as distinguished from the more recent influences of the historic religions—the Hindu Buddhist, and the Mohammedan. The flat, painted bark cloth which preceded woven textiles in the East Indies is a good example of old Malayan decorative art media. This art was continued in Celebes, where the rectangular sitting mats with their dark colored, angular figures are characteristic. According to Doctor Hough designs on tapa from central Celebes, though geometrical, are clearly traceable to a zoomorphic motivation, representing birds and animal figures.

Among the Battaks of Sumatra, carvings in the round have a vogue. This art here reaches a high development in smaller objects as magician's wands, and realistic carvings of animals, notably the lizard.

Thus in the reciprocal relation of Indian culture traits and a great insular population arose Malaysian or Indonesian art. Influences continued throughout many centuries, the origin of such major achievements as the introduction of weaving, house architecture, and the working of metals antedating the Christian era.

Weaving ornamentation was at first limited to banded designs in perhaps only two colors; later, more colors were added and the space between the bordered bands was filled in with decorative designs. In woven scarfs of the Battaks of Sumatra, and the fabrics of Sumbawa, east of the island of Bali in the smaller Sunda Islands, in Flores, in Timor and other islands do we see the introduction of additional colors and of the blending into the subdued shades of Indian textile decorative art. The foundation color of the tied textile is dark blue or red; patterned designs are in yellow or blue, white or red, even green.

Blending of colors is effected by the tie and dye method, whereby the warp threads and the woof threads are separately tied and then dyed. To achieve the desired color pattern, the process has to be repeated many times, but a complicated loom is not required. Much skill and patience such as only the Malay can put into his labor are prime requirements. Decorated cloths thus ornamented are best known from the island of Bali. Some of the rarest examples of tie and die ornamented textiles and most intricate designs appear on the so-called burial cloths, where a 5-pointed star occupies the central field. This is surrounded by a galaxy of Hindu Buddhist gods and

other religious motives. Precious cloths from Java and Sumatra, from Palembang and Atjeh betray Indian influence. In these textiles, gold threads are woven into the design as in the wonderful Siamese textiles of similar description.

Siamese influence may also be noted in house architecture in Sumatra. Houses of the Minangkabau Malays were originally built upon piles, but are now on stone foundations. The outer walls are covered over with carved decorative designs. These are particularly noticeable on the gable ends, of which there are many. The peculiar swayback roof-tree, the concavity of which extends all the way from gable end to gable end, may be seen also in other regions all the way to the Caroline Islands and Guam on the east and to the Massim region in east New Guinea on the south. This type of house architecture might be termed truly Indonesian. The decorative designs are either geometric or floral. Houses of the Battaks of Sumatra are similarly decorated with carved friezes on the wooden gables. The floral patterns of the Bornean Dyaks alternate with the interlocking dog-tail motive. In this respect Dyak art resembles the curved and recurved carved spirals of the Maori.

Pictorial art is also represented on the decorated gable ends of the Indonesian house. Painted figures of human beings, of animals, of land and sea, of trees, mountains, and other objects illustrate the mythology and historical deeds of the Indonesian house builder. Colors used in this form of pictographic art are mostly red, but white, yellow, and black also occur. These are houses of the Tobabattaks of Sumatra, of the Toradja of Celebes and of the natives of Palau. It should be noted that this pictorial art bears no relationship with the Australian-Papuan painter's art, as it arrived in Indonesia at a late date from India and elsewhere on the Asiatic mainland. Even at that, this type of decorative house architecture is historically one of the oldest in the world.

In classifying Malayan decorative designs as founded on floral, geometrical and faunal motives, it is well to note that the religious influence of Mohammedanism checked the use of animal motives to a great extent. Hinduism and Buddhism, on the other hand, stimulated the use of the lotus flower motive, although most Malayan artisans fail to recognize the motive as such, merely following the conventional style of wood carving or damascening as the case may be. What has been recognized as geometrical designs in ornamentation may readily be explained as conventionalized floral motives in many instances, particularly in the ornamentation of metal objects, such as the kris guards and ornamentation on brass vessels.

Malay craftsmen use terms to designate simple designs, namely "clove flower," "mangosteen calyx," "Solomon's seal," "Bo-tree

leaf," "bamboo sprouts," and "flying-fox elbows." Certain types of covered metal bowls from Sumatra, covered cups, and trays, cups for holding betel-nut are often designed to represent the lotus flower, the petals of which may be in relief or engraved. The flower of the gourd vine and other flowers are occasionally engraved in the center of metal plates or as a motive for concentric bands. The lotus may also appear on large metal belt buckles, with the petals beaten out in relief and arranged around the central boss.

The so-called fern curves pattern, from the curving of the shoots of the fern frond, is a design applied by the Sumatran Malay and by the Bornean Kayan. This is combined with the conventional "dog" pattern, parts of which end in trifid shoots, the backs of the dog being bent to form a meandered series.

Swastika motives are fairly common and may occur with direct or indirect (counterclockwise) arms. All these designs appear in insular Malayan art and on the Malay Peninsula, even to a limited extent in Siam, as in the niello work of that country.

The fish-tail motive is illustrated in Ceylonese work and in the Malayan type of water dipper in which the coconut bowl has attached to it a handle of wood with cleft or "fish tail" end. In the Sinhalese specimens the coconut bowl has an ivory handle shaped like the fish-tail Malay handle, however, in rather complicated form, as it is usually represented as a fish submerging down the mouth of the whale-elephant, only the tail being visible.

It is frequently difficult to distinguish between Javanese and Hindu or Buddhist art objects. This is particularly the case in carved figurines or decorative friezes. Stone and bronze decorated figurines and vessels are frequently undistinguishable, the Javanese from the Indian and vice versa. The same confusion results in Balinese work, as the island of Bali was in part settled direct from India; also from the introduction of wayang figurines from India, which are used with or without masks in theatrical entertainments in Java and elsewhere in the East Indies. Indian color predominated in one type of wayang, in which pictures are introduced. In the more Javanese types of wayang ("pura" and "klitik") carving in leather or in wood betrays the more characteristic Malayan preferences in design motivation and technique, as contrasted with Indian love of color. This is seen also in the vivid yellow painting of the Geruda-bird carving, on which is mounted the goddess Visnu (Krishna), a splendid example of Balinese art directly influenced by Indian mythology.

Banded decorative devices of triangles painted or woven into the matting and textiles, the design representing the fern frond or a bamboo shoot, are to be seen everywhere in Malaysia, in Bali,

Lombok, Borneo, Lampong, Minangkabau, Atjeh, everywhere the Hindu kingdom had penetrated. The Hindu kingdom of Majapahit controlled the destinies of the Javanese for more than 1,000 years, but was overthrown by the Mohammedans in the year 1478, just before the arrival of the Spanish explorers and the beginning of European influence. On the island of Bali the Buddhism and Sivaism of its native population remained in power. This is reflected in the decorative art of these island populations to the present day. In Java, the Buddhist art continues among the Sundanese.

The kris (keris) hilts from the Malay Peninsula and from Sumatra have but little decorative work. The human figurine which forms the hilt is not well developed as in krisses from Bali and Lombok, although some of them have small figurines sometimes represented merely by a few transverse cuts in the wood. The typical pommel decoration from the Upper Malay Peninsula is the kingfisher motive. This is closely similar to the typical pommel decoration on the Javanese kris. Although the kris is supposed to have originated in Java, the Bugis type is much more widely disseminated. This is no doubt due to the aggressive Bugis character. Marsden says that Macassar and Bugis people came in trading prahus to Sumatra and that "Malays affect to copy their style of dress, and frequent allusions to the feats of achievements of these people are made in their songs. Their reputation for courage, which certainly surpasses that of all other people in the eastern seas, acquires for them this flattering distinction. They also derive part of the respect paid them from the richness of the cargoes they import."

The introduction of iron to Malaysia dates back to a time before the beginning of the Christian era. It had, however, not yet reached Micronesia or Polynesia at the beginning of the exploration of the Pacific by Europeans in the sixteenth century. Malayan weapons and armor are excellent examples of the thorough penetration of metal working into Indonesian culture complexes, some of the best examples of native Malayan ironwork being fashioned by these interior Indonesian tribes who have not been reached by Mohammedanism. The kris (keris) of the Mohammedan Malay is perhaps the best example, showing both ancient Malayan, Hindu, and Mohammedan art motives. Meandered lotus flower, Naga serpent designs inlaid on the blade, and stylized dog or kingfisher figurines shaped from dugong ivory on the conventionalized pommel, also wayang figures on guard or pommel—all denote separate and distinct culture stratification and influences from Malayan and Indian sources.

*Influence of culture stratification on Filipino decorative design.*—In the Philippines, for example, are a large number of tribes, both Indonesian and Negrito, exhibiting almost every stage of culture

from the Negrito upward. The civilized tribes, the Visayans, of Bohol, Cebu, Leyte, and others occupy the central islands, while the Tagalog, Ilocano, and Bicol are representative of Luzon. More typically Malayan are the "uncivilized" Manobo, Mandayan, Subanun, and Bagobo of Mindanao, the Bukidnon of Mindanao and the central islands, the Tagbanua and Batak of Palawan, the Bontok, Ilongot, and Ifugao of Luzon.

Several types of culture influence have been dominant in the Philippine Islands. The late Christian influence, which began with Legazpi and his conquest of the Philippines in 1564, is characterized by a Catholic education. The widespread influence of the Christian doctrine provided a widely diffused veneer of European culture. Mohammedanism had been introduced in Mindanao approximately in 1380, and spread rapidly to northern parts of the archipelago. A Mohammedan settlement was established at the present site of Manila, but yielded to Legazpi in 1571. Mohammedan designs are noticeable in the southern islands, particularly in Jolo and in the large island of Mindanao.

Back still further we find a direct influence from India. This may be seen in certain religious design motives engrafted on purely Malay customs. Tavera has traced the survival of hundreds of Sanskrit words. Perhaps the art of metal work as it is still practiced in Luzon, where iron is predominant, and in Mindanao where, as in Borneo, brass work has been developed, shows Indian influence to have penetrated Malayan culture much more deeply than have the comparatively recent Mohammedan and Christian intrusive religions.

Still another influence must be reckoned with in considering Malay art, and that is the Chinese. The Chinese have traditions that they visited the Philippines as early as the ninth century, and from the thirteenth century on their records show trade with the Philippines and with Borneo. Chief among these trade articles were Chinese pottery, brass gongs, and bronzes, weapons and art works, and a vast array of more material objects. Chinese influence was limited to such trade goods and there is no trace of a social or institutional influence, although China is much nearer the archipelago than is India. Back of these influences from without, of course, is that of native Malaysian culture.

In art designs the Filipino has drawn widely on environmental plant forms and animal life, beautifully executed leaf and floral patterns in wood carving or in cast and filigree metal work, which appear with inlay of soft metal in color. The pineapple design, wayang and anito figurines, and carved zoomorphic dog and leech motives are characteristic of those tribes uninfluenced by Christi-

anity. It is only with the introduction of certain Hindu and later Christian symbolism and images that we find a mixture of native Malaysian design and extemporaneous forms. A splendid example of the Malay leech motive is the repoussé design painted over with bitumen on the walls of a miniature wooden coffin box secured by Stirling from the Dyaks.

In Malayan chow pots and bowls of cast brass, also in kettles and lamps, are occasional protuberances. The same technic is noted in Malayan silver betrothal cups. A variation of this may be noted in the fluted pedestal bases to be seen both in silver and brass ware from Malay centers of metal craft. The Malays call the irregular surface an imitation of a pineapple pattern. The protuberances, or "gadrooms," resemble also Siamese work, but the general form of the brass and silver bowls and vases from Borneo and Mindanao closely resemble Javanese forms. The protuberances, or "gadrooms," also resemble the lotus pattern which is found on the base of Buddhist idols.

The Bagobo of Mindanao in full regalia illustrates well the art of a primitive Malay tribe in the exuberant ornamentation of weapons of offense and defense, and of textiles. Embroidery of appliqué beadwork designs on textiles in a technic entirely different from that of the American Indian is the outstanding element of Bagobo decorative design. The carving of geometrical designs in flat relief on wooden shields, also the repoussé ornamentation and applied decoration on metal spears and cutting blades, is excellently done by the artisans of this primitive pagan Malay tribe.

*Malaysian basketry.*—The basketry of the Dyaks of Borneo is unrivaled for strength, fineness, variety, and skill in construction. Rattan and bamboo, tough and resistant, are materials capable of being readily and evenly divided, and splints of any length can be easily made. The braided or plaited basketry ferrule rarely exceeds one centimeter in width. It is unknown elsewhere in the Tropics, but it is of frequent occurrence throughout Malaysia. Many of the specimens combine joinery work with basket weaving, and the knots, loops, windings, and other fastenings often show marvelous ingenuity. While the Dyaks excel in delicacy of work, they are weak in decorative patterns.

The materials employed are derived from pandanus, which yields baskets of a soft and flexible texture; from leaves of various palms of paperlike texture; and from split bamboo and rattan, which make baskets of a rigid structure. The forms are flat bags of pandanus and palm of artistically twilled weaving in different colors, varied with complicated openwork like lace; flat telescopic baskets, circular and hexagonal in shape; and napiform and globose baskets of



rattan. They are put to an infinite variety of uses: For ornament, for containing small objects, for the storage of food, and for the transportation of articles. As a rule the surface decoration of Malay baskets is the result of the style of the weave more than of the color of the materials.

*Malaysian wood carving.*—Household gods, shrine images, and other religious objects from southern Malaysia range from a simple billet of wood rudely representing the human figure to elaborately carved and decorated images, which are in many cases costumed. The shrine images are usually fastened together in a row and placed in the neighborhood of the house, where they receive various offerings, the customary one being the blood of a slain animal or a stone which represents food. Larger images are placed in shrines along the seashore. The smaller images, blackened by smoke, are male and female household gods whose headdresses indicate rank. Some of these show great skill in carving, though the faces are expressionless. The hands are brought up toward the chin, and, as a rule, clasp a bowl for the reception of food. The legs are also flexed and the knees prominently shown. The more rudely shaped images and idols are simply hewn out of the crotch of a tree, and a face with human features is cut from one side to form an anthropomorphic representation of one of the many of the ancient gods of Malaysia.



## EXPLANATION OF PLATES

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### PLATE 1

Ethnic areas in Oceania.

### PLATES 2 AND 3

Marionettes of cut leather and carved wood from Java.

The small hand and rod operated puppets of the Javanese represent their ancient culture heroes and the creatures of Hindu mythology. Those of cut leather (U.S.N.M. No. 168224), illustrated in Plate 3, are called *wayang purwa*, while a more recent form of marionette is known as the *wayang klitik*. The latter is shaped from wood, is rod operated, and is used in puppet shows glorifying historical characters of the ancient Malay kingdom of Majapahit. The *wayang* figures are used in shadow pictures accompanied by a monologue of the operator. Appropriate music is rendered by an orchestra of bamboo xylophones and brass gongs. The gongs are often exquisite examples of Malay metal craft and decorative art, while the *wayang* combines decorative art and theatrical amusement. The *wayang* of carved wood is illustrated as dressed in decorated Javanese batik cloth. U.S.N.M. Nos. 168225, 168227 from the World's Columbian Exposition, Chicago, 1893. Related forms of the marionette occur in Burma, Siam, and southeastern Asia generally. The hulu marionette of the Hawaiian Islands is distinct in symbolism and expressed art.

### PLATE 4

Hawaiian royal feather cape.

### PLATE 5

Woven cloak of the Maori, New Zealand.

### PLATES 6-9

Tapa cloth from Samoa, Hawaii, Fiji, and Santa Cruz Islands.

The stamped decorative designs are based on alligator patterns and other motives taken from life forms. These have been conventionalized and are broken up into their component parts to fit the requirements of the space to be decorated.

### PLATE 10

Decorative art of the Maori of New Zealand.

Polynesian art, more particularly that of the Maori, is manifest essentially in wood carving, also in tattoo marks. Mummified Maori heads on which the skin and hair remain intact are in the National collection along with other Maori art objects, such as wooden dressing boxes, carved sections of wooden house posts, carved and inlaid feeding funnels, and carved combs of whalebone. These were collected principally by Lieutenant Wilkes, United States Navy, in 1838.

Maori wood carver's art is illustrated by engraved double spirals in flat relief, also by shell inset. The repeated use of the eye form as a decorative device resembles the art of the Haida Indians of British Columbia and of southeastern Alaska.

The objects of carved wood illustrated are dressing boxes, U.S.N.M. Nos. 3785, 3786, collected by Lieutenant Wilkes, United States Navy, from the Maori of New Zealand.

## PLATE 11

- a, End view of a dressing box of wood collected from the Maori of New Zealand by Lieutenant Wilkes, United States Navy, in 1838-1842. U.S.N.M. No. 3787.  
b. Cast of feeding funnel. Maori of New Zealand.

## PLATE 12

Section of house post belonging to the Maori of New Zealand, collected by A. W. Converse, U.S.N.M. No. 334017. Dimensions: 25 inches long, 9 inches wide.

This wooden slab is typical of Maori decorative design painted with red ochre in shark's oil. It consists of grotesque totemic figurine carvings with protruding tongue, flaring nostrils, and high brow ridges. Nacre of pawa shell oblique inlay represents the eyes of the figurine.

The form of relief engraving generally is that of an incomplete spiral resembling the decorative designs engraved on the lids of work boxes, and tattooed on face and body. In a general way totemic figurines carved on Maori house posts resemble the totemic devices to be seen on carved house posts of the Haida and allied tribes of southeastern Alaska and British Columbia. As in southeastern Alaska, a totemic figure is represented, but in anthropomorphic form, while the carved designs of southeastern Alaska are zoomorphic with only occasional anthropomorphic features.

Structurally there is a wide divergence in the areas compared; this Maori figurine being highly conventionalized, and the figurines of the Pacific northwest coast being realistic in the extreme. In both areas the design is commemorative of some ancestor.

## PLATE 13

Objects illustrating the wood carver's art of the Marquesans and the Rarotongans.

Left: Carved wooden stilt, U.S.N.M. No. 3792, collected by the exploring expedition under Lieutenant Wilkes, United States Navy, in 1838.

Right: A carved wooden dagger, U.S.N.M. No. 5345, collected by Captain Aulick, United States Navy.

## PLATE 14

A ceremonial adze of black palm wood from Hervey Island, probably the most exquisite example of wood carving known among primitive peoples. U.S.N.M. No. 3719. Collected by Lieutenant Wilkes, United States Navy, in 1838.

## PLATE 15

Ceremonial adzes from Hervey Island and the Marquesas illustrating the decorative wood carving technic of the Polynesians, U.S.N.M. Nos. 3719, 3722. Collected by Lieutenant Wilkes in 1838.

## PLATE 16

a, A Moro chow pot of cast brass from Mindanao, P. I., collected by Mrs. H. C. Corbin. U.S.N.M. No. 258287.

The diameter is 10.1 inches and the depth 5 inches. A detachable tray serves also as a lid. It is a generally accepted form of Malay metal food container, which in rare instances is duplicated in silver. It has numerous protuberances on the globose walls, forming what is called by the Malay

the pineapple pattern. The base, a flaring pedestal form, is flattened and widespread, detracting from the beauty and harmonious proportions of the vessel. It is said that the reason for the wide pedestal bases on metal food jars in Malaysia is the method of floor construction in Malay houses; the split bamboo sections being exceedingly irregular, causing a vessel with narrow base to spill its contents over the floor. A floral design encircles the upper margin. There is also a linked scroll design resembling a loose plaiting or braid.

- b. Betel nut box of cast brass, U.S.N.M. No. 257654, length 6 inches, height  $2\frac{1}{2}$  inches, width 3 inches. Lanao tribes of the Mohammedan Moros, Mindanao, P. I.

The box is provided with hinged lid and handle lugs at the ends. Within are three compartments. In one is kept the leaf of the Piper betel, in another the Bouaa nuts, and in the other lime. In use, a section of the leaf is placed on the hand, and a cut section of the nut and some lime is added. This is rolled and chewed. This habit turns the teeth black, which is fashionable. The box is rectangular, and is in contrast with the numerous crescent-shaped Buyo sets of cast brass designed to be carried at the side under the armpit. Walls are plain. The lid has a meandered double volute filigree design in relief resembling that on the brass tea caddy just described, and the painted volute scroll designs on the basketry betel nut boxes from Celebes.

#### PLATE 17

Malay vessels of cast brass, and shell inlay on wood.

Upper left: A miniature globose vessel of cast brass, U.S.N.M. No. 257712,  $2\frac{1}{2}$  inches high and  $4\frac{1}{2}$  inches in diameter, is a typical example of the pineapple design, incorporating on its walls an embellishment consisting of series of protuberances and spurs resembling the spines of the pineapple plant. Two of the flaring brass spurs had been broken off and repaired with brass rivets by the native Malay workmen. Collected by E. A. Mearns from Mindanao, P. I.

Upper right: A decorated wooden trinket box, U.S.N.M. No. 232809, collected by E. A. Mearns in Mindanao, is globose in form and has a wide pedestal base. The characteristic Malay inlay forms a triangular fretted design encircling the base and margin. In this wooden vessel the inlay consists of the nacre of shell. Dimensions: Height, 2.4 inches; diameter, 3.3 inches. Inlay on brass chow pots is in a light-colored metal alloy.

Bottom figure: A teapot of cast brass, U.S.N.M. No. 232779, with a diameter of 8 inches and standing 6.6 inches high. The vessel has a distinct Hindu cast, but incorporates on the decorated walls the Malay pineapple pattern in relief. The flaring pedestal base has a fluted relief embellishment. The pot is provided with a spout, lid, and loop handle, with a meandered cast filigree design in relief encircling the vessel near the margin and on most of the upper surface of the lid. A conventionalized dragon figure connects the end of spout with a lug supporting the looped handle. It is an excellent example of Moro metal work in cast brass from the Lake Lanao country of northern Mindanao, where, in the village of Taguya, brass is still being cast in the form of decorated chow pots, cannon, storage vases, pipes, chains, jewelry, and other objects.

## PLATE 18

Upper: Betel nut box from Sirah, Middle Celebes, collected by Dr. W. L. Abbott. U.S.N.M. No. 283958. Dimensions: 8.4 inches long, 2.6 inches wide, 1.2 inches in diameter.

This betel nut box consists of sections of pandanus leaf sewn together and covered over with strips of mica; the mica is brought in praus from Banggai Island on the east coast of Celebes. The box has a twilled basketry lid; a meandered floral design in color is incorporated in the walls under the covering of mica.

Lower: Decorated pommel, ferrule, and scabbard of Malay steel barongs from Jolo, Philippine Islands. The barong at right, U.S.N.M. No. 288361, has a silver-shod handle of lauan wood and a decorated pommel of dugong ivory. The ivory and carved wooden pommels of the barong at the right are excellent examples of the "leech" pattern, a decorative motive widely diffused throughout Malaysia. Stirling found Dyak porters carving objects in this intricate pattern while resting on the journey. The ferrule of plaited silver wire on the handle of the barong at the left is an exquisite example of Malay metal filigree work and resembles the well-known Malay plaited ferrule of rattan. Apparently nowhere else in tropical countries do we encounter this characteristic use of rattan. The braided Malay ferrule, whether of silver wire or of rattan, rarely exceeds 1 centimeter in width.

## PLATE 19

Carved wooden spoons: Philippine Islands.

A typical form of Malay design from the Ifugao and Igorot of the island of Luzon consists of figurine or spirit images forming handles of carved wooden spoons. These spoons have plain bowls, but invariably have anthropomorphic figures occupying the handles. They represent "Anitos," or spirits whose qualities, both good and bad, are known only to the primitive Malay.

Some of these sculptures are of interest, others are quite crudely done. Illustrated are two examples fairly typical. One, U.S.N.M. No. 248011, 8.2 inches in length, has a handle representing a spirit or "Anito" in erect posture with arms at the side and touching the knees. He wears a plumed headdress represented by a 2-lobed extension of the crown of the head. The other spoon illustrated, U.S.N.M. No. 35127, has a figurine handle more typical of Igorot wood carving generally. It represents an Anito with flexed knees, and with hands resting on thighs.

Like all primitive peoples, the primitive Malay wood carver represents a life form in the least possible number of planes. A straight line extends from the top of the head to the lip, forming, thus, forehead and nose in one plane. The face is triangular, extending in two divergent planes to the ears, where protuberances are invariably carved.

There is nothing of great interest in these carvings, and the general level of decorative art here seen is inferior to that of Malay etched designs on bamboo or executed in metal.

## PLATE 20

A bamboo comb, collected by Gen. Tasker Bliss, U.S.N.M. No. 236641, from Mindanao, has characteristic Malay art embellishment occupying a panel at the base of the comb. Zigzag nucleated circles and fretted designs form

panels set off from one another by incised lines. All of these form a border leaving a central field in plain natural color. This art is perhaps most characteristic of the Philippine-Malay areas.

The tubular container collected by Haskell, U.S.N.M. No. 341501, 7½ inches in length and 7 inches in diameter, also the slightly larger container, U.S.N.M. No. 334538, collected by Miss I. H. Lenman from the island of Luzon, resemble rather closely the etched designs of a tubular bamboo container from Africa, U.S.N.M. No. 334402, collected by R. C. Bielinski. The similarity is to be noted in the triangular and lozenge-shape etched banded designs forming panels covering the entire surface of the containers. Such designs, along with other protean designs, such as V-shape, alternating spurs, are too elementary to be of any value in a study of cultural diffusion.

#### PLATE 21

##### Decorative work in bamboo: Malaysia and Melanesia.

Wherever bamboo is grown the tribe or people occupying the region has seized upon it as an effective medium for carrying out their artistic impressions. Some of the best examples of decorative engraving or etching on bamboo come from Malaysia, as shown on the plate, in the form of 6-stoppered flutes. One of these, characterized by lightly etched rather than by the more usual broad banded designs, U.S.N.M. No. 235159, is from the Philippine Islands. It has a length of 31 inches and a sectional diameter of 0.9 inch. As in other examples of Malay art on bamboo, the banded designs tend to the geometric and are symbolic, although they originated in patterns of life forms. Series of V-shapes, rectangles, zigzags in parallel, hourglass devices—all are conventionalized representations of reptilean forms and feature, such as scales.

Five flutes from central Celebes, U.S.N.M. No. 304191, collected by W. L. Abbott, are shown on this plate. They incorporated, along with the decorative design just described in the flute from the Philippines, a number of conventionalized zoomorphic designs, principally of horns and head of the water buffalo. The head of the animal is represented in the form of a lozenge-shape device often split into triangles. There is otherwise little difference from Philippine designs except in the depth or broadness of line etching. The art resembles somewhat the banded burnt etching on blowguns from the island of Palawan.

One of the flutes on this plate, U.S.N.M. No. 394191, Sanggana, slightly smaller in diameter than the other examples illustrated, introduces white and red paint which, alternating with the burnt sections, gives a pleasing effect. The encircling panels covered with red stain frequently have a decorative design realistic in character, differing from the more geometrical lozenge-shape, and line patterns in burnt black. Bird representations are the characteristic theme of the etched panels in red, while the water buffalo is the motive in the burnt line sections.

#### PLATE 22

A bamboo stem, U.S.N.M. No. 232790, shown at upper right of plate, used as a container, was collected by E. A. Mearns in the Philippines. It is 5½ inches long and 1.8 inches in diameter. Encircling designs etched by burning are in wide zigzags, triangles, and encircling bands alternating with plain spaces, the whole forming a pleasing geometrical pattern.

Two containers at the upper left represent entirely different cultural areas. They were collected by M. W. Stirling from the Papuans of the Central Rouffaer River Valley in Dutch New Guinea. None of them exceed 4 inches in length; the shortest is  $2\frac{1}{2}$  inches long. They are stoppered at one end with the uncut nodal diaphragm, the other end being open and, in use, being extemporaneously stoppered with leaves. U.S.N.M. No. 338671.

These decorated bamboo receptacles are used as lime containers in connection with the chewing of betel, also as needle cases, and for other purposes. It is interesting to note that the decorative design is etched on the walls by cutting away the outer cortex in sections, thus introducing by contrast a 2-color pattern, as is the practice of the aboriginal peoples of Central and South America. The outer cortex remaining forms double spirals resembling Maori decorative devices, V-shaped figures, also certain tadpolelike designs. Execution of these designs in Papua is inferior to Malay work, being crudely done and giving an amateurish impression, while the finished work of the Malay artist approaches virtuosity.

A lime container, U.S.N.M. No. 304151, shown at lower right of plate, used in connection with the chewing of betel, is introduced here by way of contrast. It is from central Celebes and was collected at Bada Toeare by H. C. Raven for Dr. W. L. Abbott. It is an elongated cone-shaped gourd, stoppered with a piece of bamboo in which have been inserted several nondescript pieces of colored cloth. The designs are the same as those previously described in connection with the Malay flute from that area. The general effect is pleasing in that each design, each panel, is a perfect example of free-hand etching. Encircling bands of zigzags, triangles, water buffalo horns, and other features, belonging undoubtedly to the water buffalo motif, are harmoniously separated by undecorated panels.

A decorated gourd shown at lower left of plate, collected by W. E. Curtis in Africa, U.S.N.M. No. 280894, 6 inches long and 2 inches in diameter at the base, introduces etched designs consisting of triangles, spurs, V-shaped frets, and encircling lines. Life forms, consisting of man and animal figures, the man holding a saber, and the animal figure resembling a lion are entirely foreign to the more geometrical art just described from New Guinea, Celebes, and the Philippine Islands.

#### PLATE 23

Examples of Fijian decorative and symbolic art.

Wood carving and painting on tapa bulk large in the art technic of Oceania. A Fijian club with symmetrically carved knobbed striking end may be seen at the left, while below are carved images in palm wood and plaited mats of palm fiber. In the background are bolts of decorated tapa, and at the right are bolts of wrapped sennit cord.

Fijian tapa like the matting shown at bottom have geometrical designs reducible to conventionalized life forms. The frigate bird of the Polynesians and the leech of Malayan designs have likewise become geometrical through conventionalization.

#### PLATE 24

Arts of the Fijians. Pottery and wood carving.

#### PLATE 25

Tattooed heads. Maori, New Zealand.



## PLATE 26

Tattoo designs, *a*, *c*, Marquesas Islander; *b*, Samoan Islander.

## PLATE 27

Decorated human heads. Papuans of New Guinea.

## PLATE 28

Wood carver's art of the Papuans of the island of New Guinea.

A tubular drum with aviform decorative embellishments in high relief. Collected by E. W. Brandes.

## PLATE 29

A 2-pronged wooden hook with elongated conventionalized aviform decoration in profile. Used in the men's dormitories of the New Guinea Papuans. Collected by E. W. Brandes.

## PLATE 30

Wooden combs from the Papuans of New Guinea. The base of each comb has etched designs in color depicting in a conventionalized manner birds and other life forms. Collected by E. W. Brandes.

## PLATE 31

Tubular drum shells of carved wood, U.S.N.M. No. 344961.

An aviform decorative embellishment carved in high relief from the solid represents the hornbill. Other zoomorphic patterns, incised in flat relief, tend to approach the double spiral of the Melanesians, and of the Maori of New Zealand. Collected by E. W. Brandes at Ambunti, Territory of Papua, British New Guinea.

## PLATE 32

Decorated objects of carved wood. Papuans of New Guinea.

Figurines of carved wood, U.S.N.M. No. 334934, used in the young men's dormitories of Papua, are excellent examples of Melanesian wood carver's art. Carving of human figurines and images in the round is general among the peoples of the Pacific. Collected by E. W. Brandes from a Papuan village located on a tributary of the Sepik River, British New Guinea.

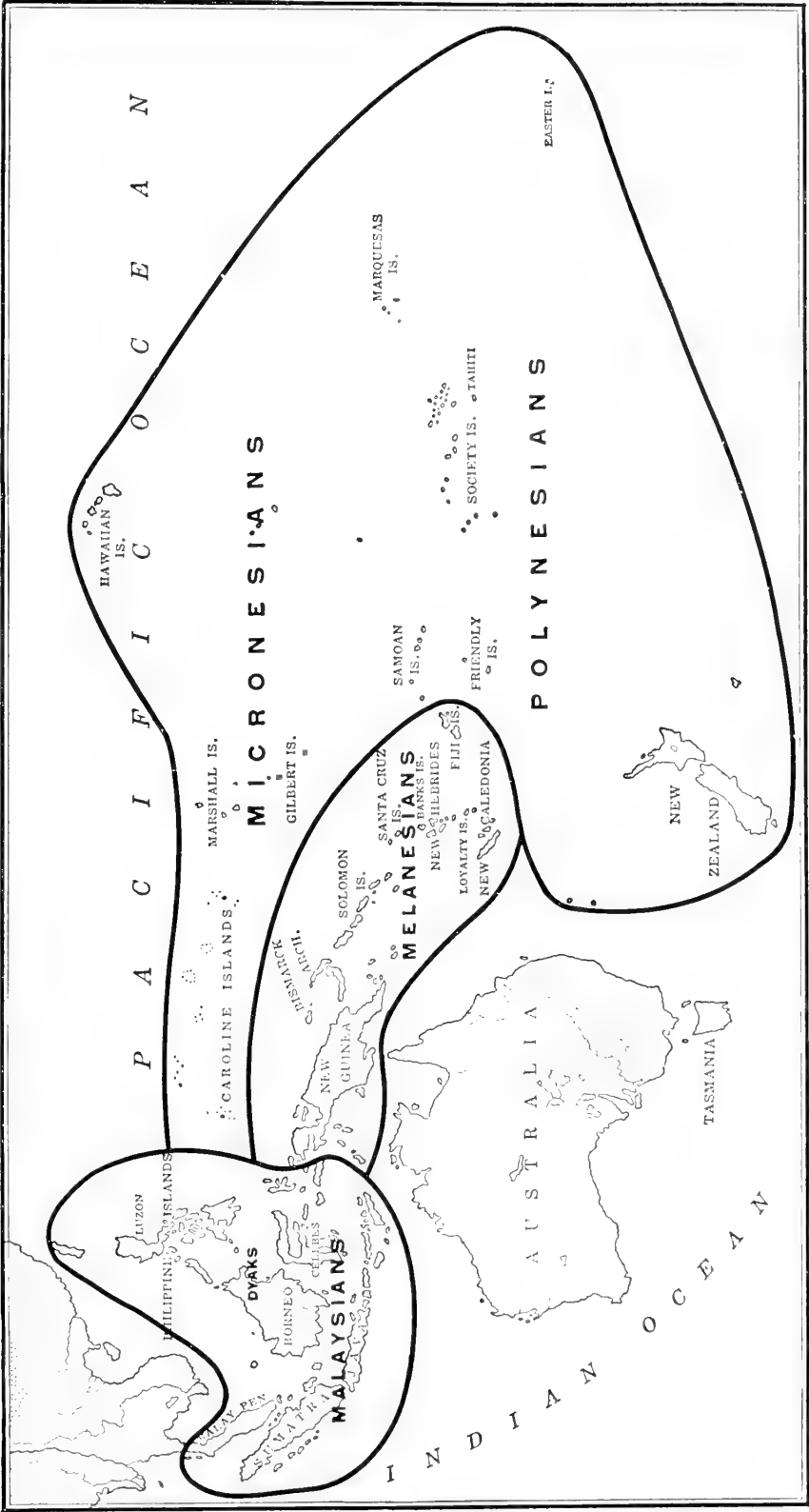
## PLATE 33

Decorated arrow shafts. Papuans of British New Guinea.

The surface etchings are filled in with a white color, a decorative technic characteristic of Melanesia. The use of red ochres as a filler in incised decorative work is also typically Melanesian and Papuan.







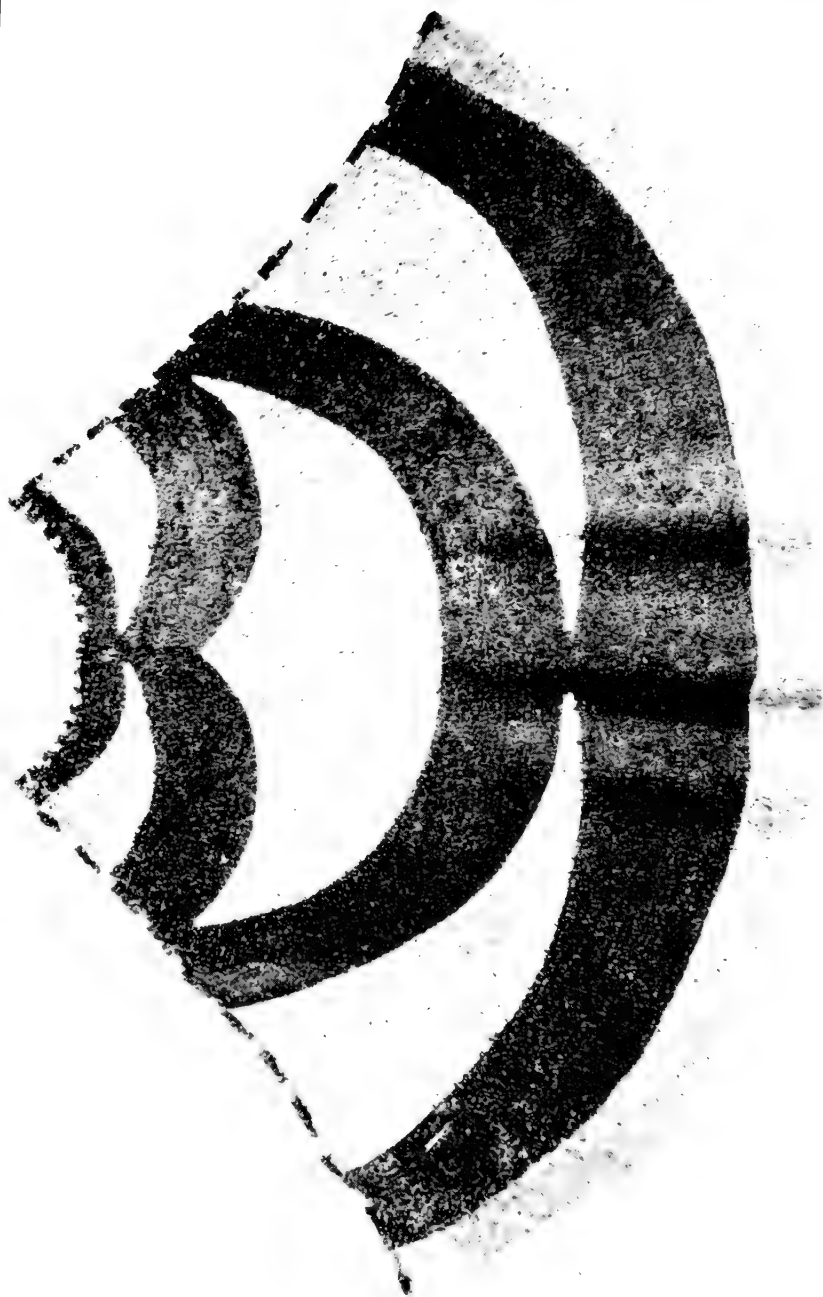
ETHNIC AREAS IN OCEANIA



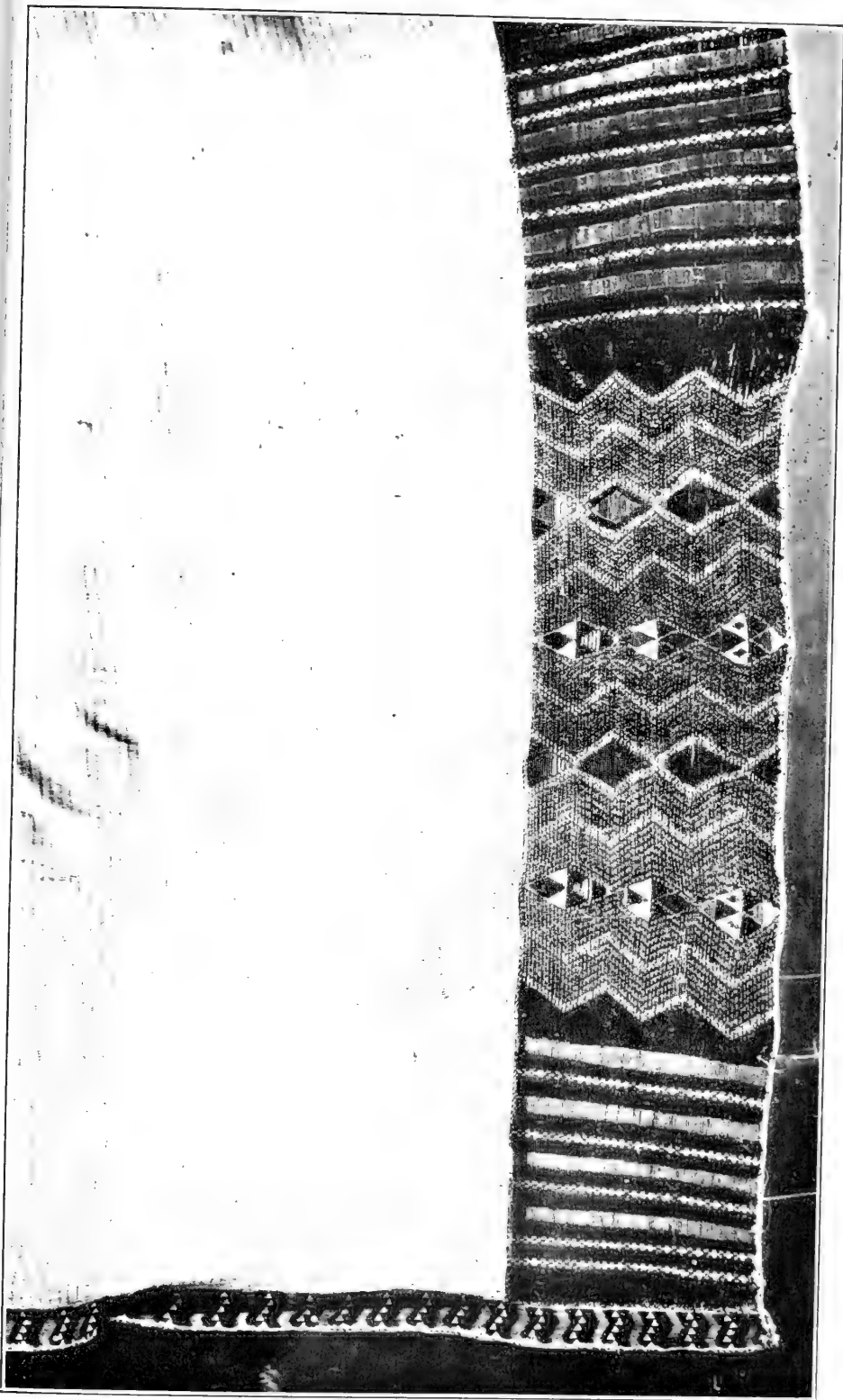
MARIONETTES OF CARVED WOOD. JAVA



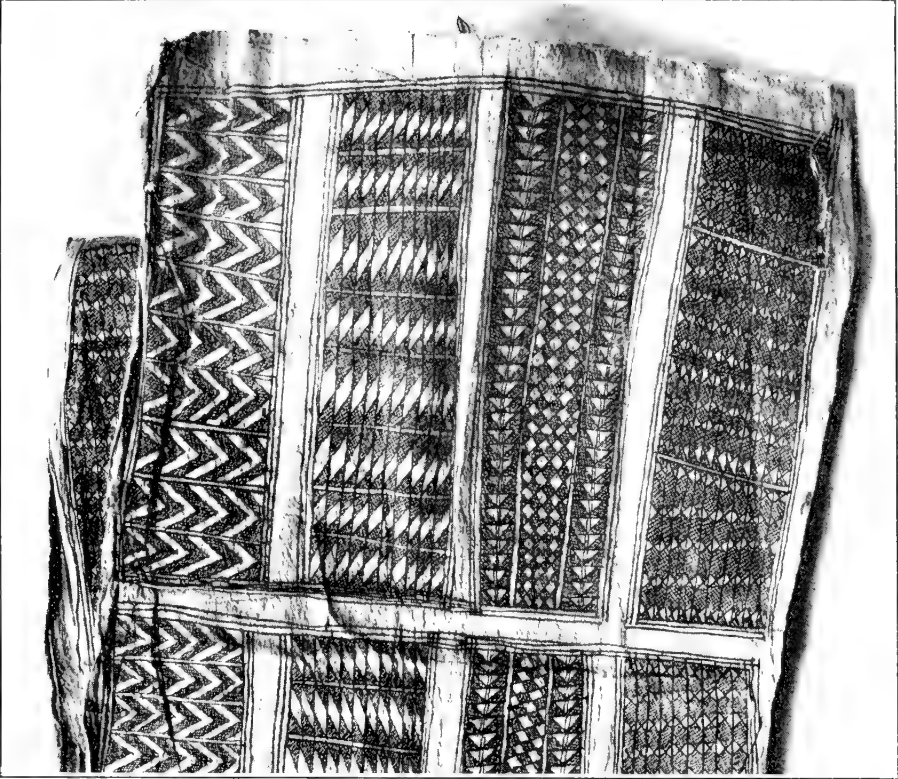
MARIONETTES OF CUT LEATHER. LEFT, JAVA; RIGHT, SIAM



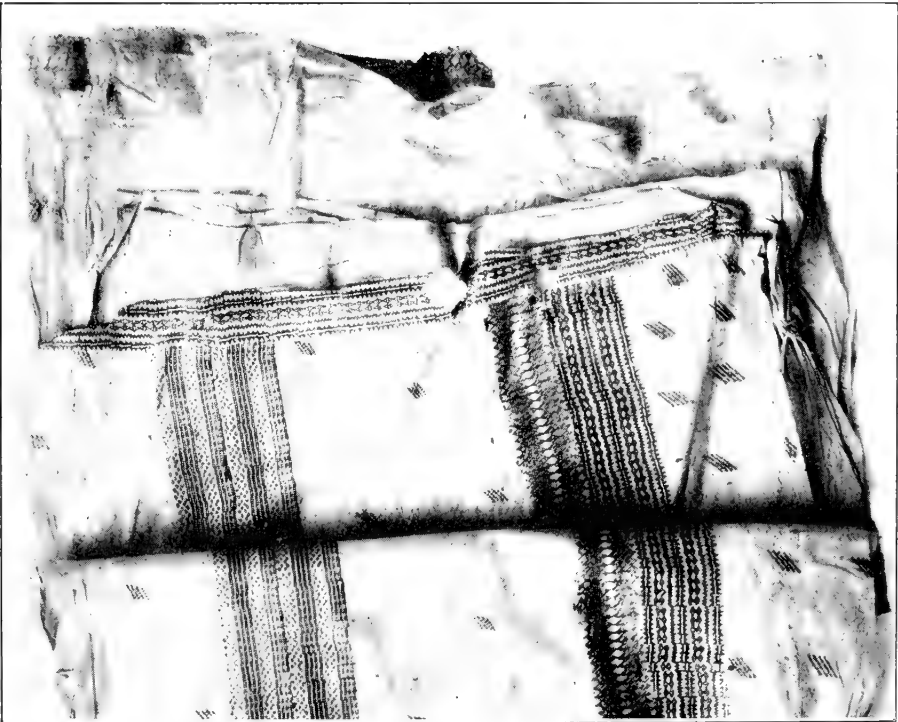
HAWAIIAN ROYAL FEATHER CAPE



WOVEN CLOAK OF THE MAORI. NEW ZEALAND

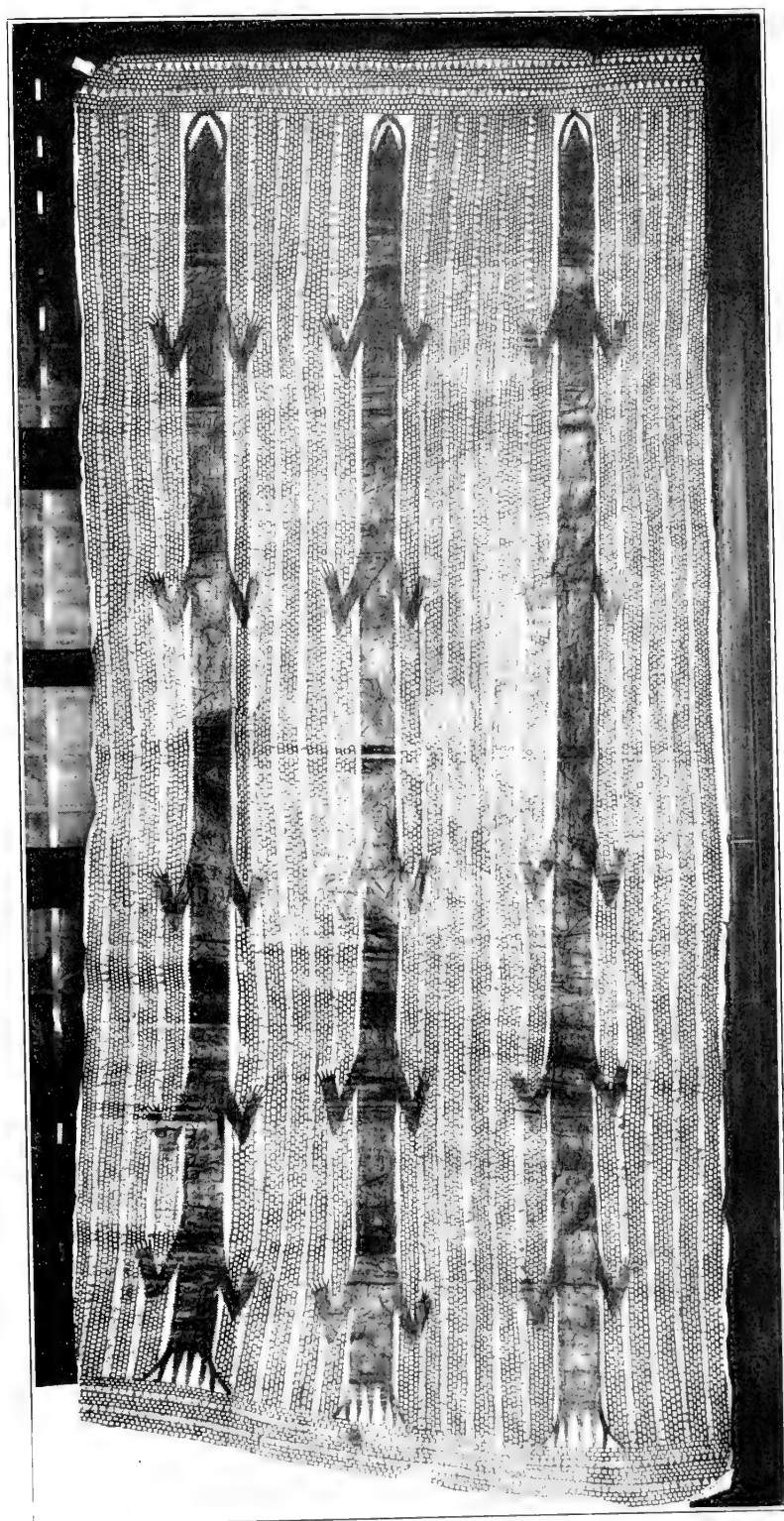


b, TAPA CLOTH. SANTA CRUZ ISLANDS

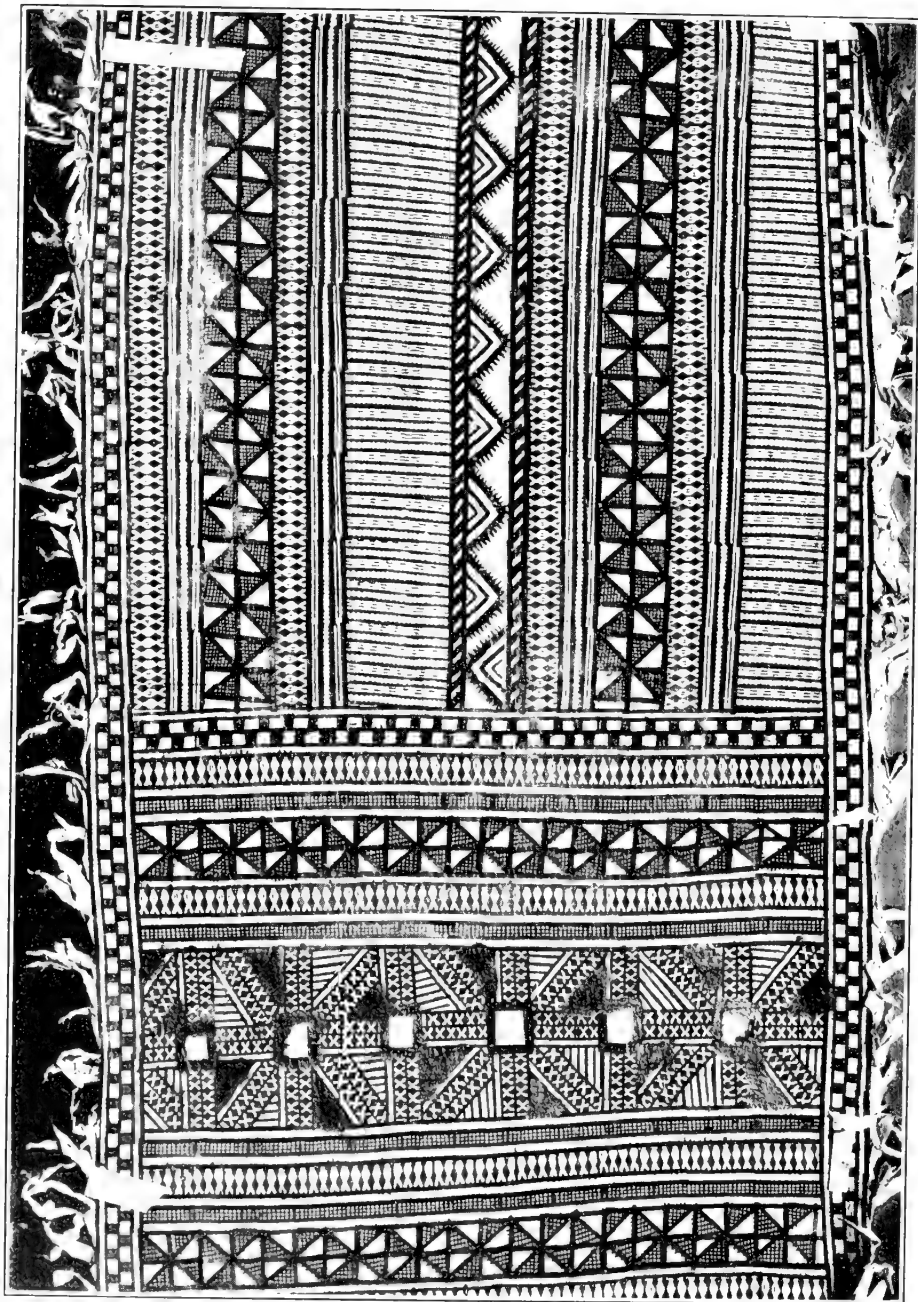


a, TAPA CLOTH. POLYNESIA

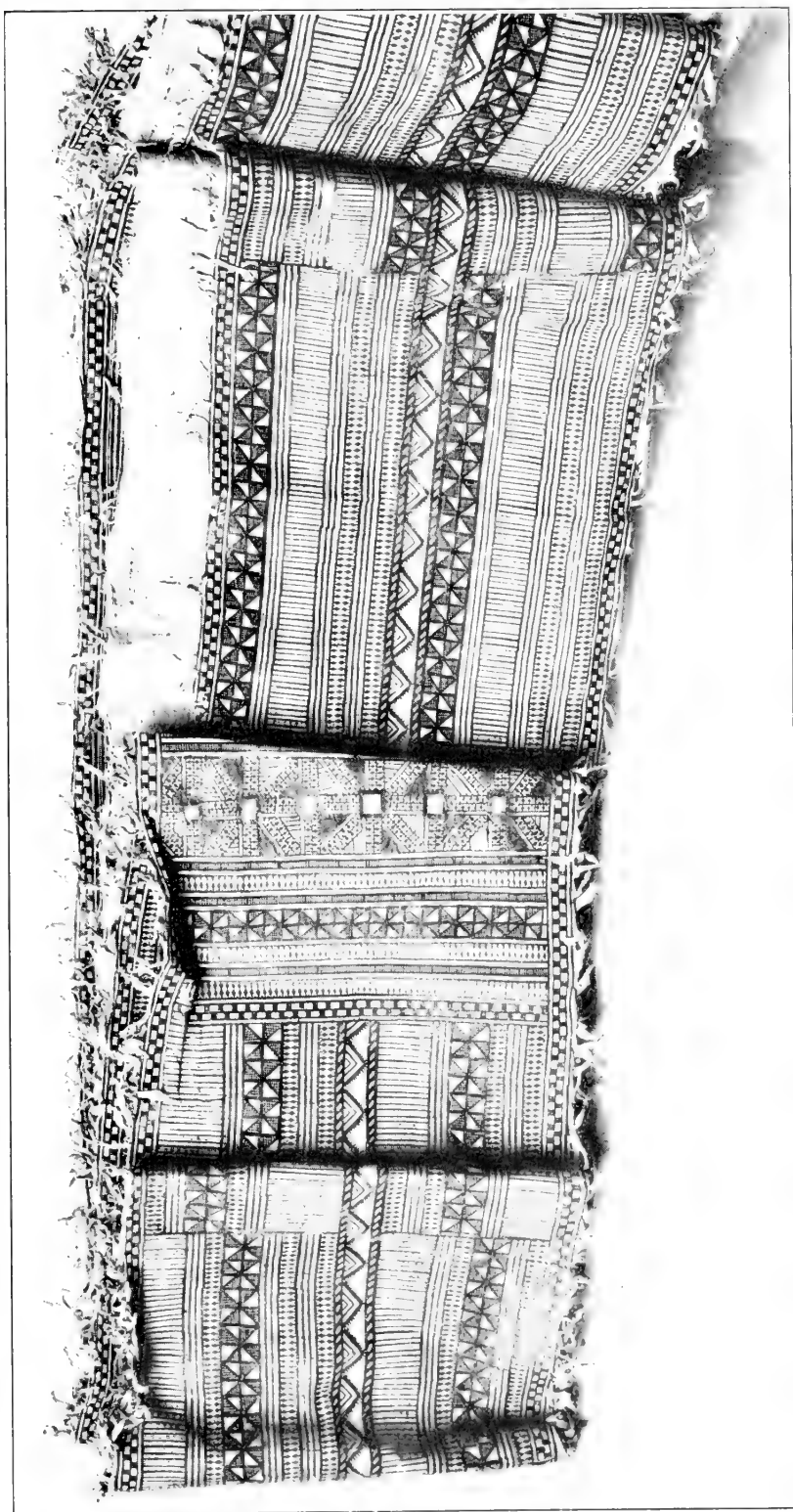




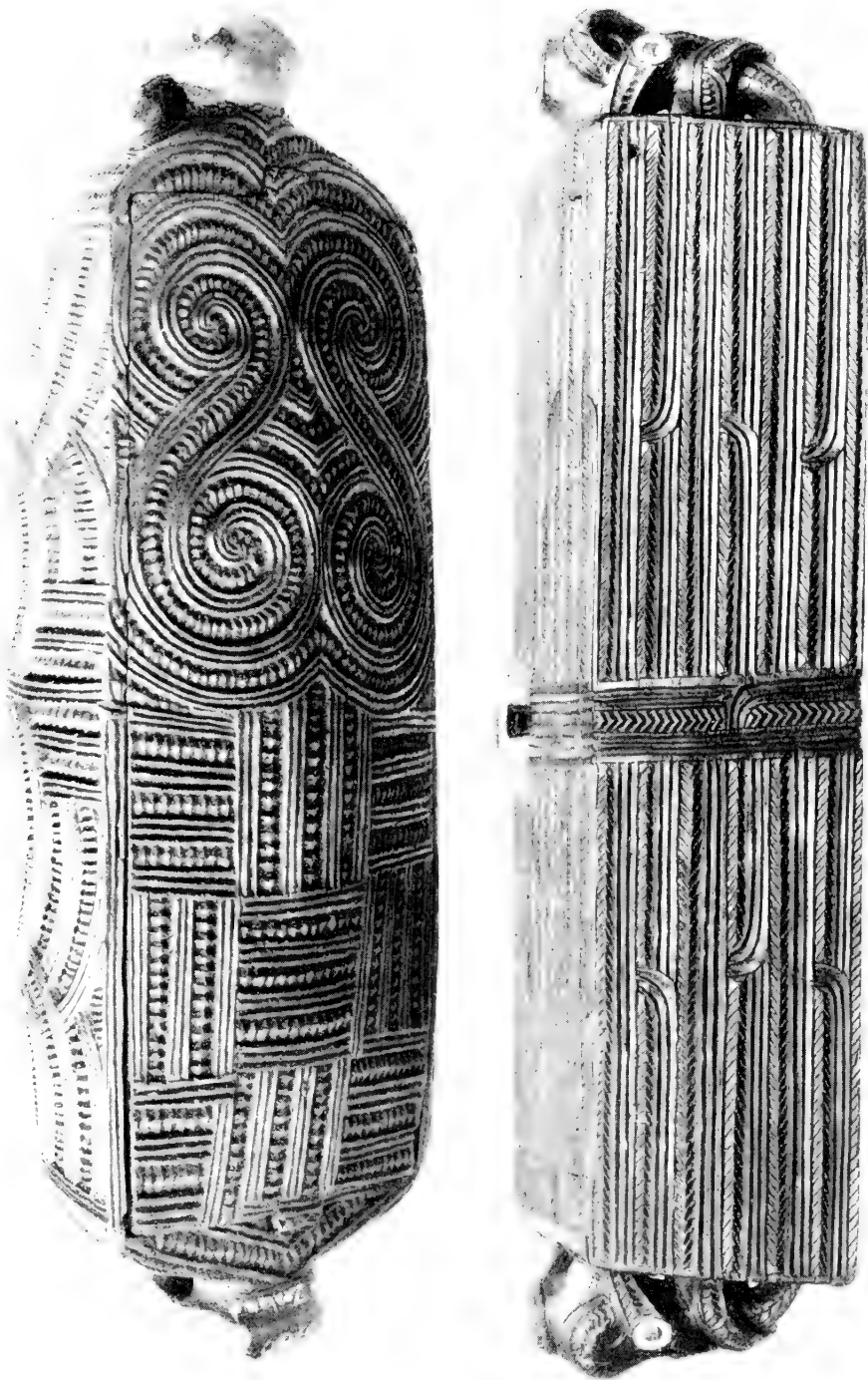
TAPA CLOTH. SAMOA



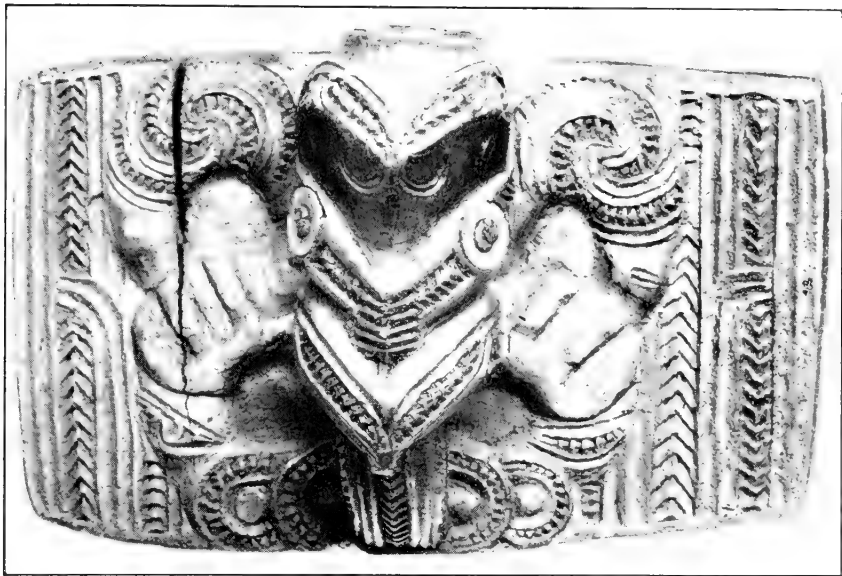
TAPA CLOTH. FIJI ISLANDS



TAPA CLOTH. FIJI ISLANDS



MAORI DRESSING BOXES OF CARVED WOOD. NEW ZEALAND  
Box at top of plate inverted to show carving and joining of lid.



*a*, DRESSING BOX OF THE MAORI, END VIEW

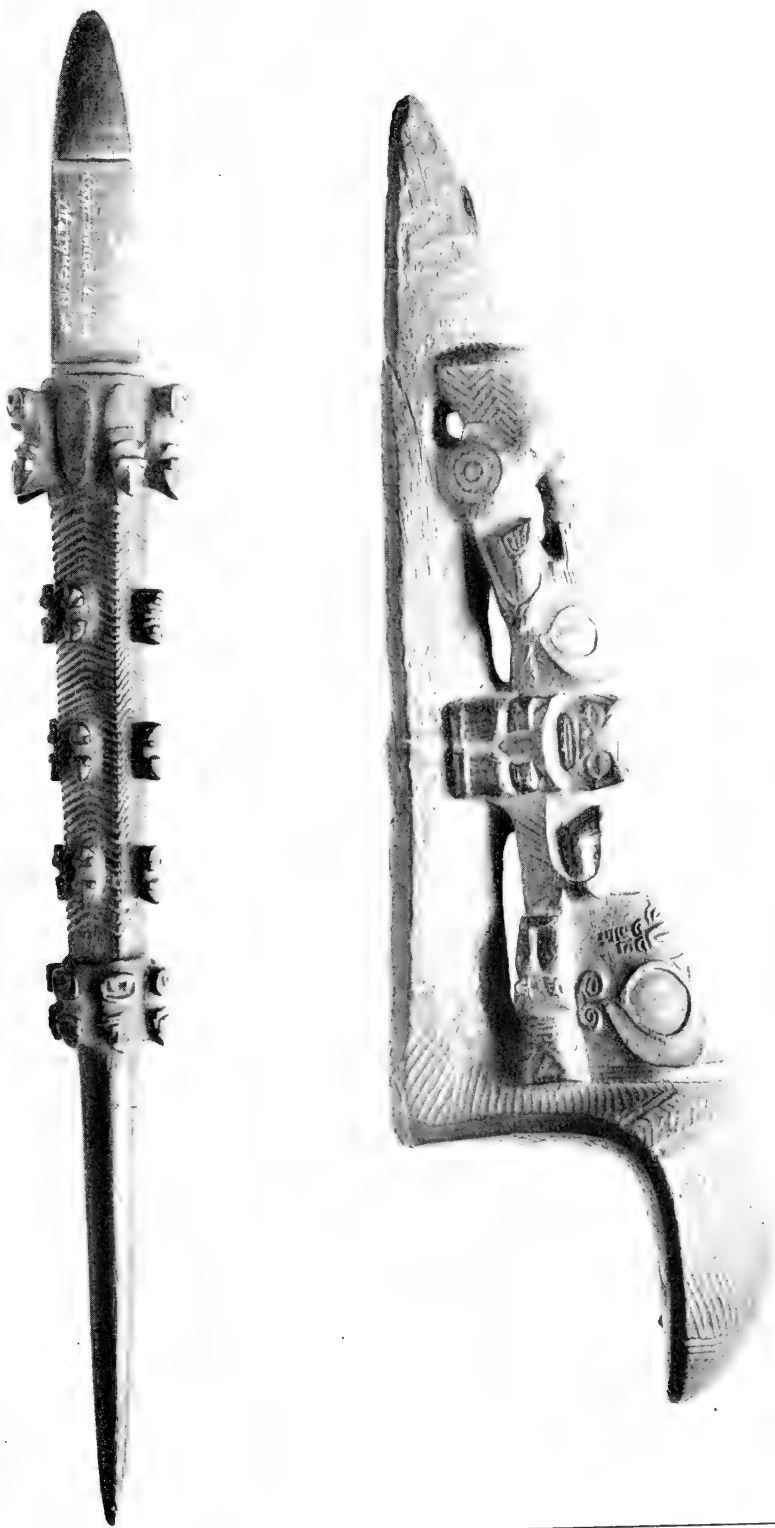


*b*, FUNNEL USED IN FEEDING A RECENTLY TATTOOED MAORI OF NEW ZEALAND

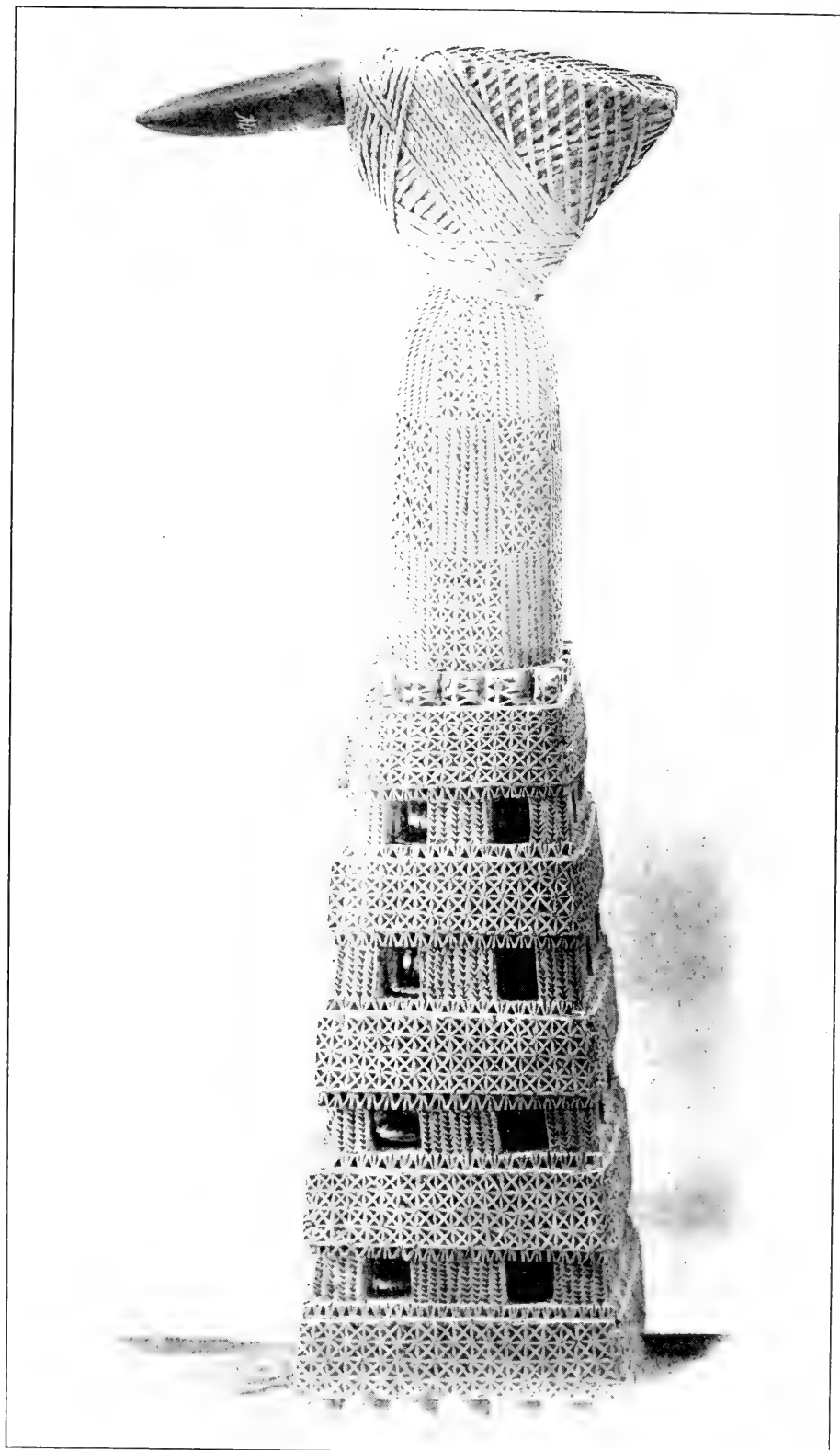


SECTION OF A MAORI HOUSE POST



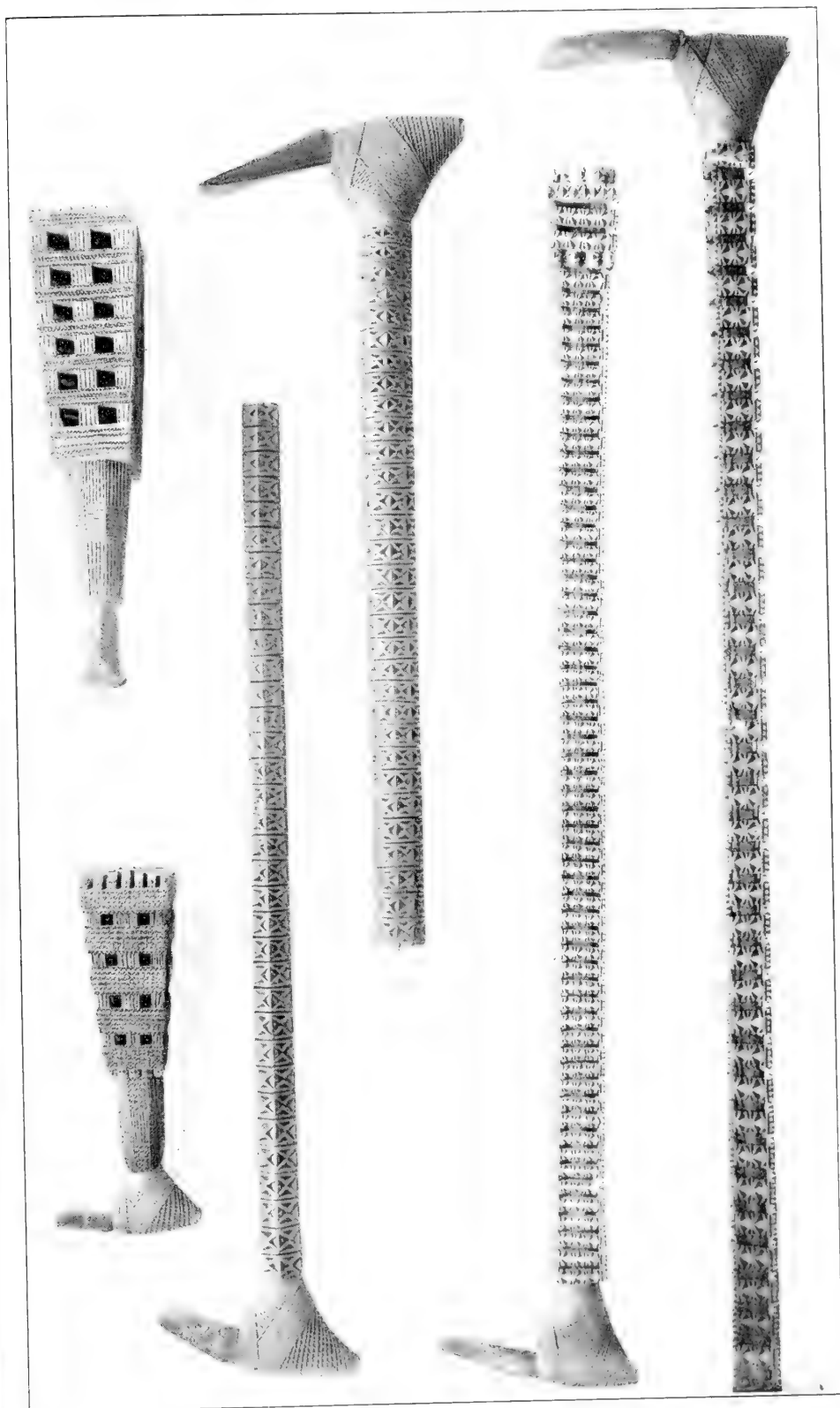


OBJECTS ILLUSTRATING THE WOOD CARVER'S ART OF THE MARQUESANS AND THE RARATONGANS



CEREMONIAL ADZE. HERVEY ISLAND





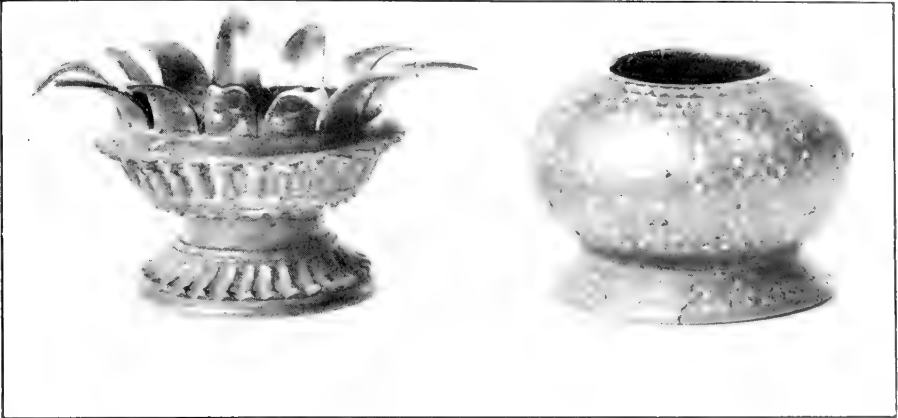
CEREMONIAL ADZES ILLUSTRATING THE POLYNESIAN WOOD CARVER'S TECHNIQUE. HERVEY AND THE MARQUESAS ISLANDS



*a*, A MORO VESSEL OF CAST BRASS FROM MINDANAO, P. I.



*b*, MORO BETEL NUT BOX OF CAST BRASS FROM MINDANAO, P. I.



LEFT, MALAY VESSEL OF CAST BRASS; RIGHT, WOODEN TRINKET BOX WITH SHELL INLAY



MALAY TEAPOT OF CAST BRASS



BETEL NUT BOX OF SEWN PANDANUS LEAF. SIRAH, MIDDLE CELEBES



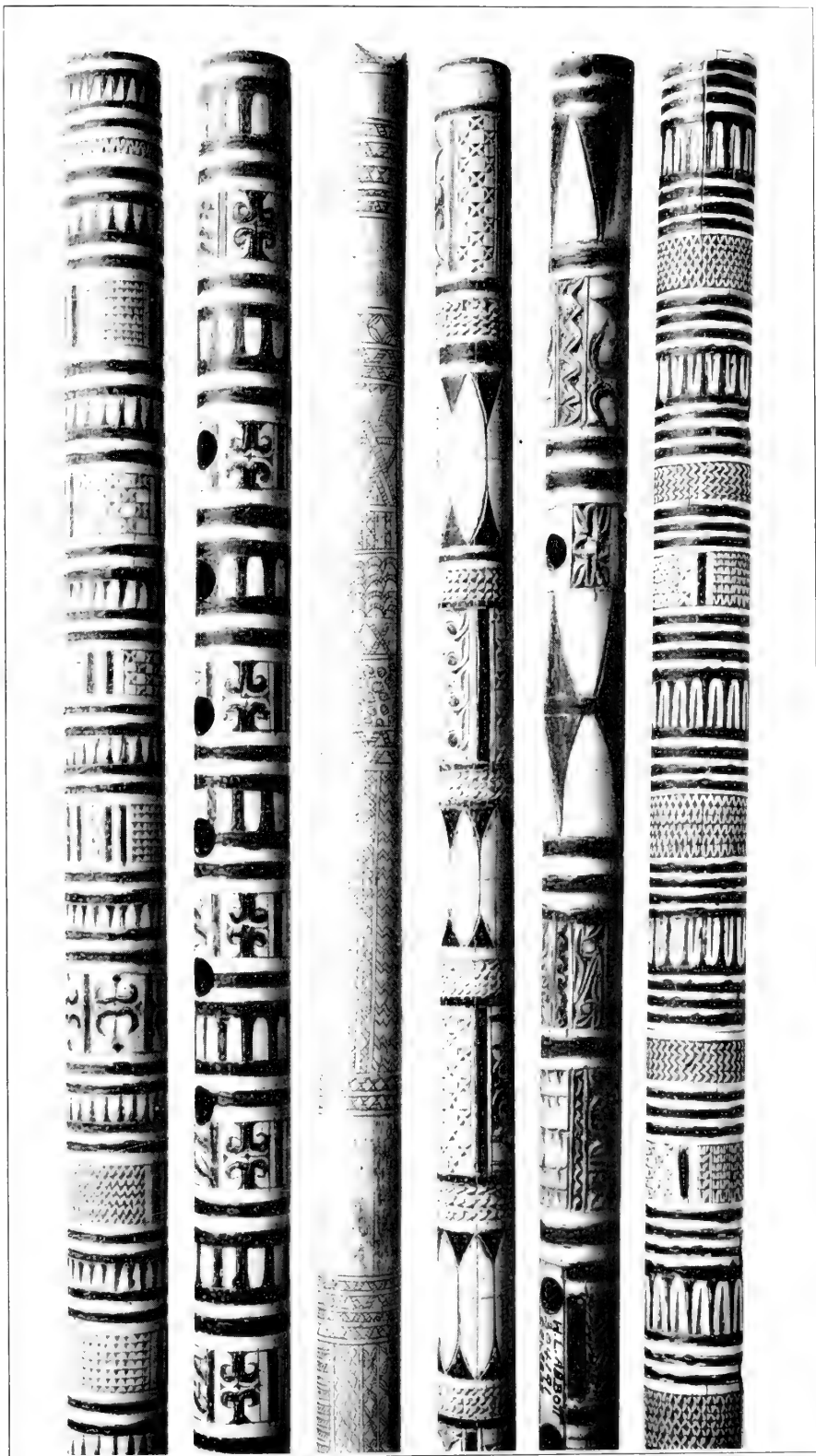
DECORATED POMMEL, HANDLE, AND SCABBARD OF MALAY STEEL BARONGS. JOLO, P. I.



WOODEN SPOONS WITH CARVED HANDLES REPRESENTING "ANITOS" OR SPIRITS.  
IFUGAS, OF LUZON. P. 1.



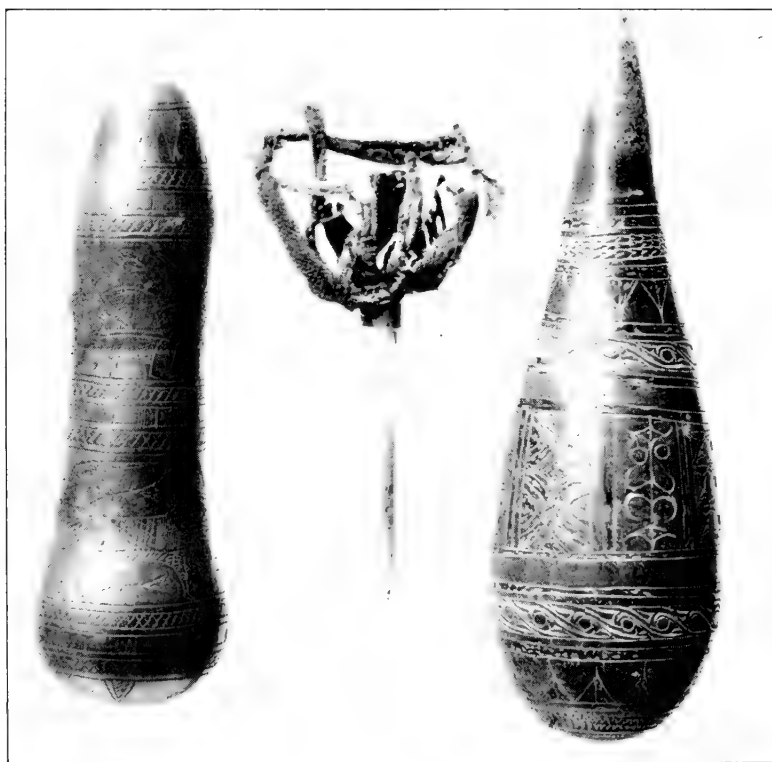
LEFT, MALAY COMB OF BAMBOO; RIGHT, TUBULAR CONTAINERS OF BAMBOO. LUZON, P. I.



DECORATED BAMBOO FLUTES FROM MIDDLE CELEBES. THE FLUTE, THIRD FROM LEFT, INTRODUCED FOR COMPARISON, IS FROM LUZON, P. I.



a, BAMBOO CONTAINERS AT LEFT AND CENTER FROM DUTCH NEW GUINEA; AT RIGHT, FROM THE PHILIPPINE ISLANDS



b, DECORATED BAMBOO CONTAINERS. LEFT, AFRICA; RIGHT, MIDDLE CELEBES



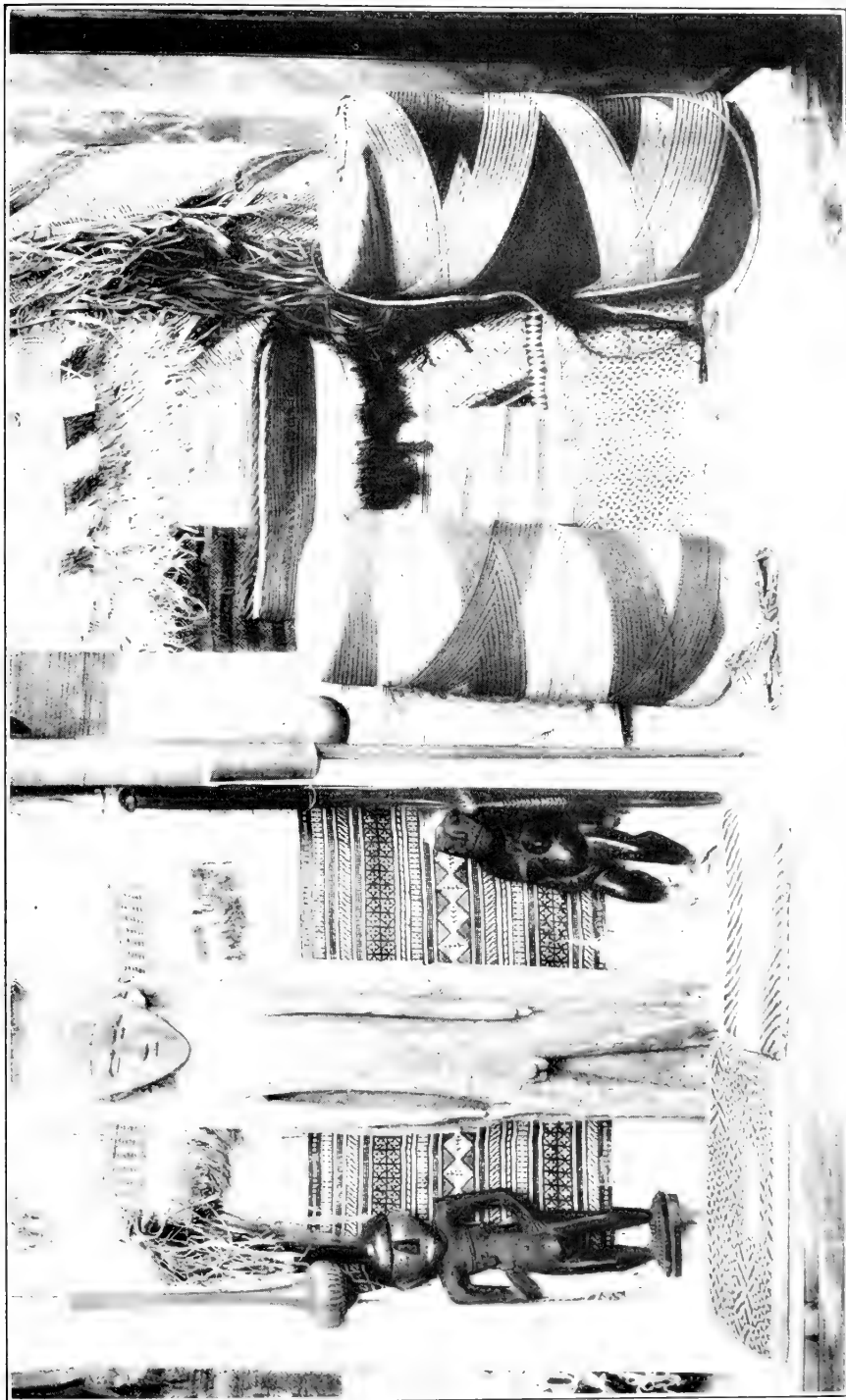
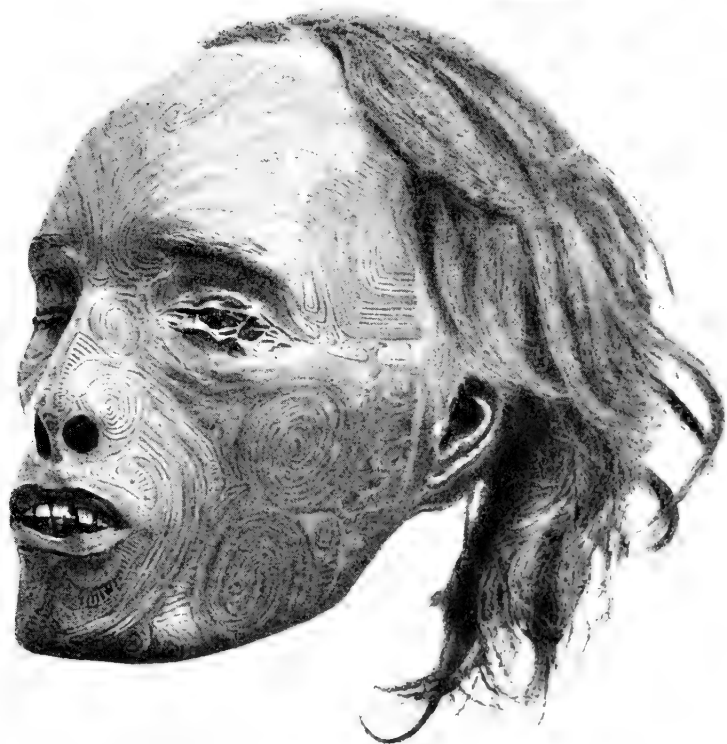


EXHIBIT OF FIJIAN DECORATIVE AND REPRESENTATIVE ART IN THE UNITED STATES NATIONAL MUSEUM



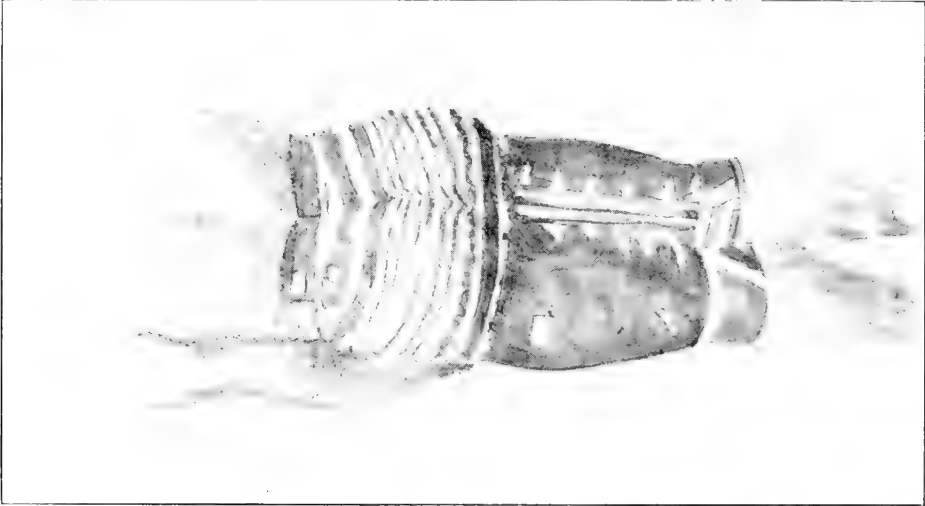
ARTS OF THE FIJIANS. POTTERY AND WOOD CARVING



TATTOOED HEADS OF MAORI. NEW ZEALAND



*c*, Marquesas

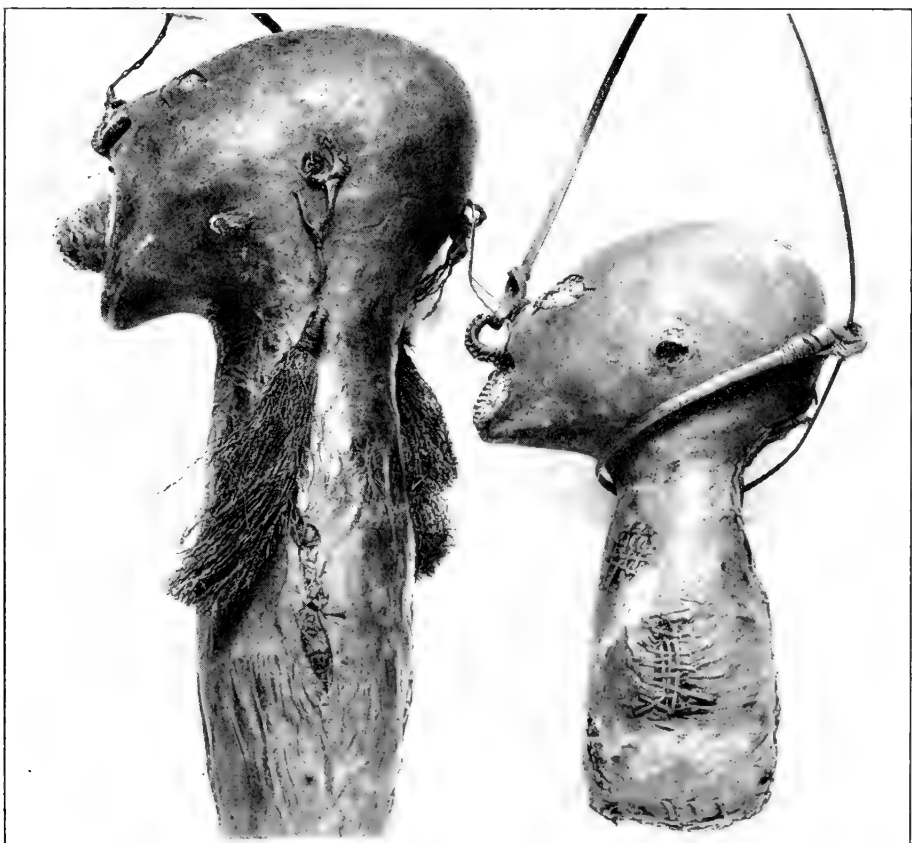


*b*, Samoa

TATTOO DESIGNS.



*a*, Marquesas



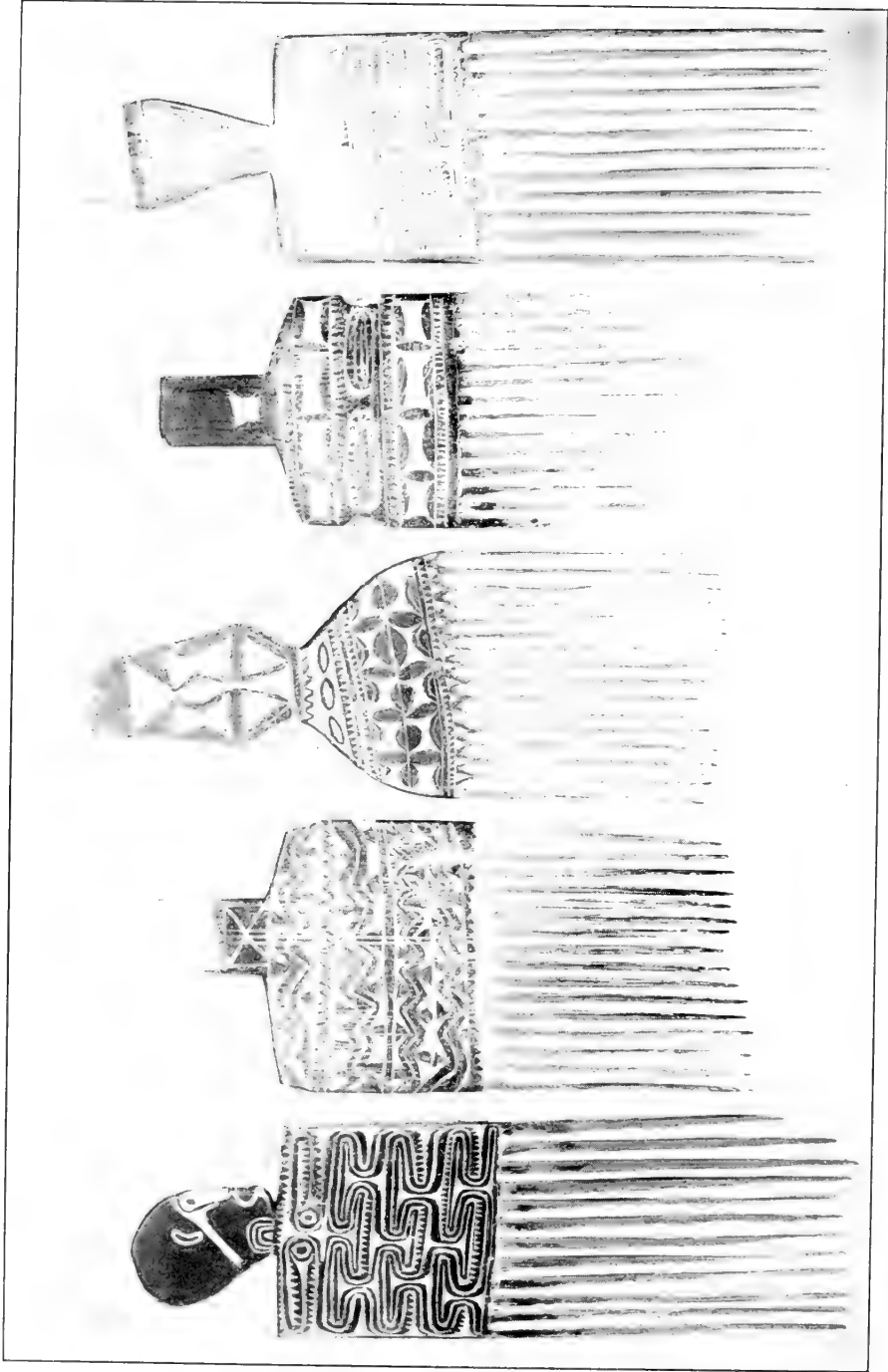
DECORATED HEADS, PAPUANS, OF TERRITORY OF PAPUA, NEW GUINEA



TUBULAR DRUM OF CARVED WOOD. TERRITORY OF PAPUA,  
NEW GUINEA

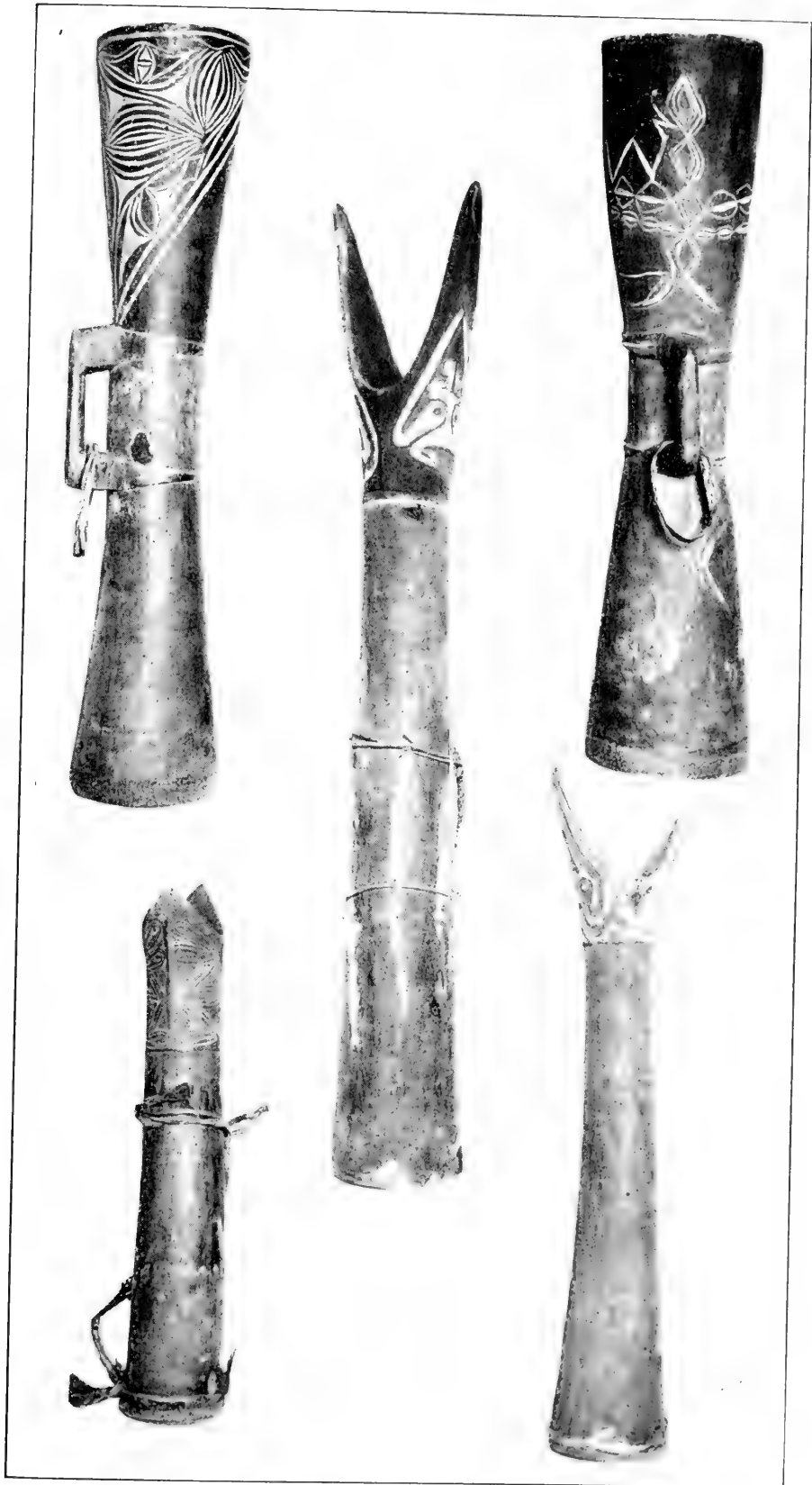


CONVENTIONAL ANCESTRAL FIGURINE CARVING SHOWING BIRD BEAK  
AND OTHER DETAILS ON PRONGED HOOK USED IN MEN'S DORMITORIES.  
PAPUANS OF TERRITORY OF PAPUA, NEW GUINEA

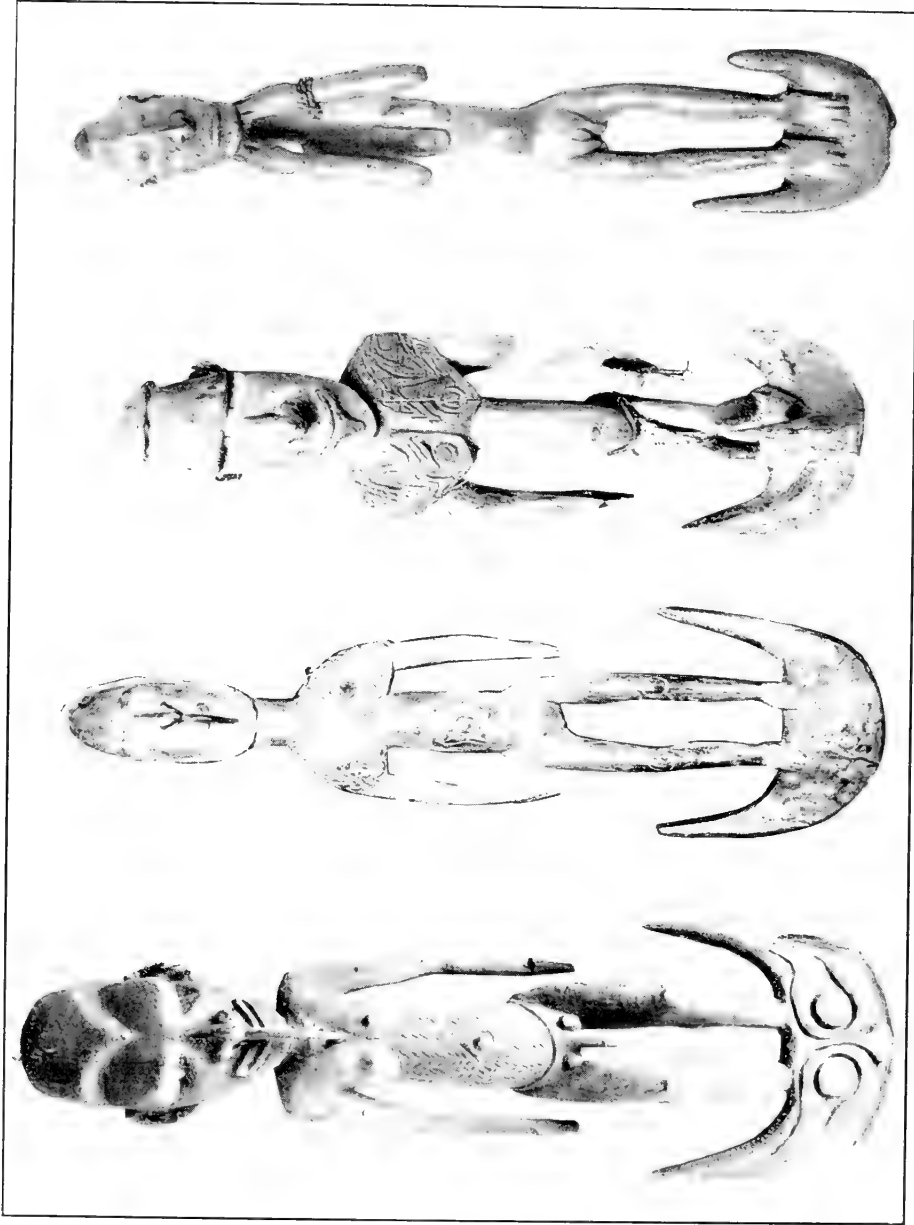


DECORATED WOODEN COMBS. PAPUANS OF BRITISH NEW GUINEA

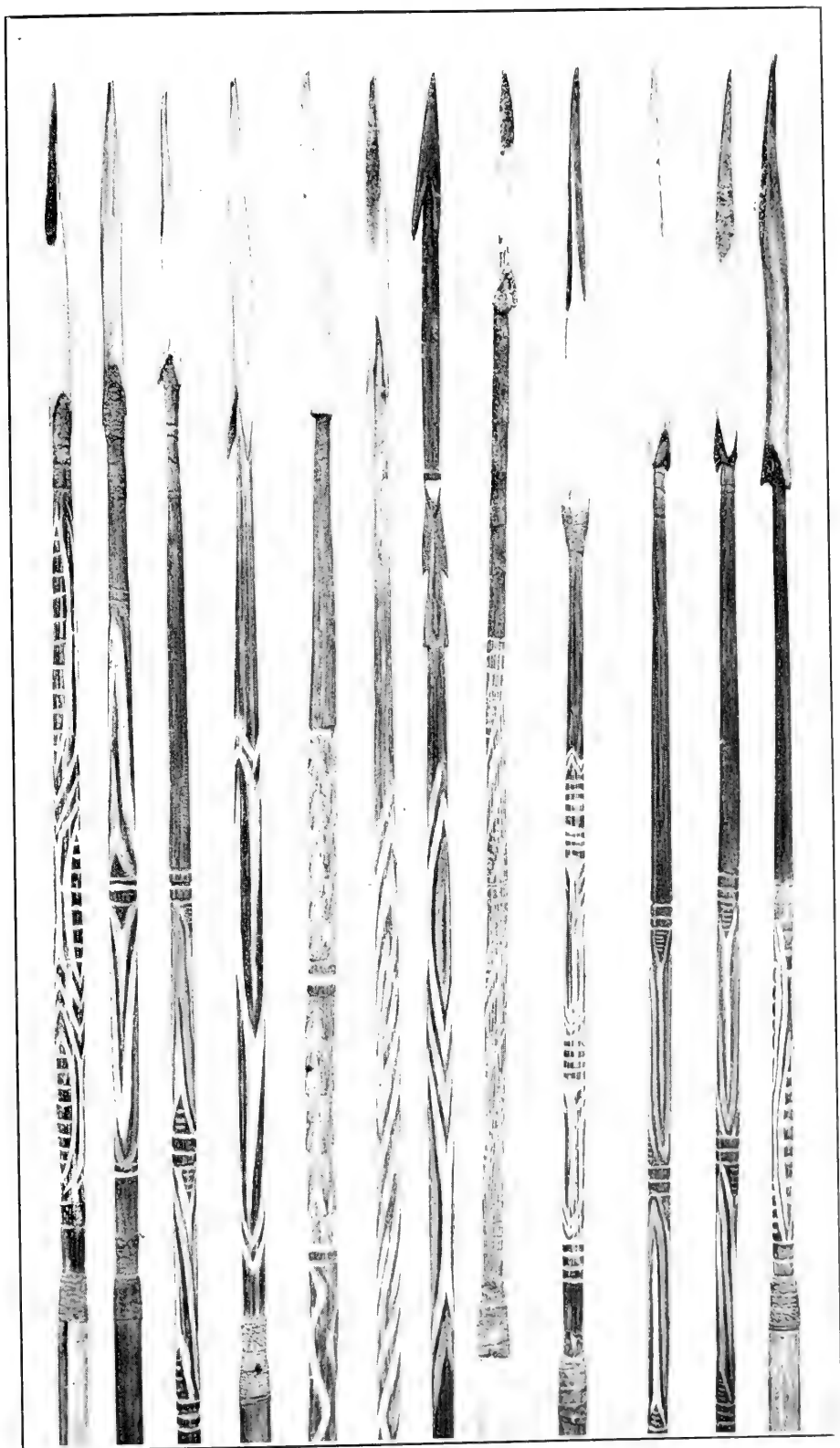




TUBULAR WOODEN DRUMS OF THE PAPUANS OF THE TERRITORY OF PAPUA,  
ISLAND OF NEW GUINEA



CARVED WOODEN FIGURINES REPRESENTING THE CONVENTIONALIZED ANCESTRAL SPIRIT WITH BIRD BEAK. PAPUANS OF THE SEPIK RIVER TERRITORY, BRITISH NEW GUINEA



DECORATED ARROWS. PAPUANS OF BRITISH NEW GUINEA



# A NEW NEMATODE WORM, VIANNAIA BURSOBSCURA, FROM THE OPOSSUM, WITH A NOTE ON OTHER PARASITES OF THE OPOSSUM

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United States Department of Agriculture

The nematode described in this paper was found in some parasitic material collected from a number of opossums at the laboratory of the zoological division at Jeanerette, La.

## VIANNAIA BURSOBSCURA, new species

PLATE 1; PLATE 2, FIGURE 1

*Specific diagnosis.*—*Viannaia*: Small, spirally coiled nematodes, bright red when freshly collected. Cephalic cuticle inflated, marked with distinct annular striations; cuticular inflation  $90\mu$  to  $100\mu$  long and  $38\mu$  to  $40\mu$  wide. Cuticle elsewhere marked with extremely fine transverse and longitudinal striations. Thickness of head  $27\mu$  without the cuticular inflation. Esophagus  $350\mu$  to  $400\mu$  long and  $35\mu$  wide at its termination.

*Male*: 4.5 mm. long and  $75\mu$  wide at its widest portion just anterior to the bursa. The bursa consists of two lateral, symmetrical lobes. The ventral and lateral rays arise from a common trunk. The ventral rays are separate and directed forward, reaching the margin of the bursa, the latero-ventrals pushing the margin of the bursa slightly beyond the general contour. The lateral rays are comparatively short; the externo-laterals are directed slightly forward, diverging from the other laterals; the medio-laterals and postero-laterals are parallel; the medio-laterals are the thickest of the rays and they curve distally before reaching the bursal margin; the postero-laterals are straight. The externo-dorsal rays are very delicate and slender with slightly curved tips; the dorsal ray has two long bifurcations, which apparently again divide at the tips; the dorsal and externo-dorsal rays are extremely difficult to find and to study because they are obscured by a dense cuticular extension on the inside of the bursa. The spicules are filiform and are  $630\mu$  to  $650\mu$  long. Gubernaculum present, lightly chitinized, about  $55\mu$  to  $60\mu$  long.

*Female*: 6.5 mm. long, tightly rolled in about 10 to 12 spirals. The muscular ovejector is about  $160\mu$  to  $180\mu$  long. The tail ends in a blunt point. The distance from the vulva to the anus is  $120\mu$ , and from the anus to the tip of the tail  $40\mu$ . The lips of the vulva are slightly elevated above the body margin. Eggs,  $55\mu$  by  $40\mu$ .

The single ovary, uterus, and ovejector in the female place this nematode in the family Heligmosomidae. It has been placed in the genus *Viannaia* because it resembles the members of this genus in the formula of the rays of the bursa and in the absence of marked longitudinal cuticular striae. It differs from them in the much greater length of the spicules, the greatest length of the spicules for the species previously included in the genus being  $255\mu$ . It resembles the genus *Longistriata* in the length of the spicules but differs from it in the absence of the longitudinal cuticular striations characteristic of the genus. It differs from both genera in the presence, within the bursa, of a dense cuticular swelling, which renders the study of the origin of the rays very difficult. Two sets of specimens were available for study. The nematodes in the first set were collected alive and were killed and fixed in hot alcohol and glycerine. The second set was collected from the viscera of an opossum sent to the laboratory from Louisiana, and this material was preserved in formalin. In the first set, killed and fixed in hot alcohol, the structure within the bursa is quite noticeable. In the second set of specimens this structure seems to have partly disintegrated, and the bursal rays can be studied with less difficulty.

*Host*.—Opossum (*Didelphys virginiana*).

*Location*.—Small intestine.

*Locality*.—Jeanerette, La.

*Type specimen*.—U.S.N.M. Helm. Coll. No. 31391.

#### A NOTE ON GNATHOSTOMA TURGIDUM AND OTHER PARASITES OF THE OPOSSUM

Among the nematodes collected from the stomach of the opossum there was found one male gnathostome. This specimen resembles in a general way *Gnathostoma turgidum* Stossich, 1902, as redescribed by Travassos (1925), but differs from it in one respect. It agrees with *Gnathostoma turgidum* in its host, both being collected from the opossum, in its size, in the number of rows of spines on the head bulb, in the character and extent of the body spines, and in the size of the small spicule. The spines on the body immediately behind the head are broad and short with 10 to 12 teeth, the spines immediately behind the esophagus are leaf-like with about 6 teeth, the spines near the end of the spinous area have 3 teeth, then follow spines with 2 teeth, succeeded in turn by single-toothed spines in densely

placed rows. The spines disappear slightly beyond the middle of the body. (Pl. 2, figs. 2-7.)

The only point in which our specimen differs from *Gnathostoma turgidum* as redescribed and figured by Travassos is in the number of caudal papillae. Travassos states that there are nine pairs of caudal papillae of which one pair is ventral and adanal and eight pairs are lateral; of the eight lateral pairs, three pairs are preanal, two are adanal, and three are postanal. Our specimen has five, possibly six, pairs of caudal papillae, of which four pairs are large, pedunculated, and lateral, two pairs of these being preanal and two pairs postanal; the fifth pair is located just in front of the fourth pair of laterals; there may be a pair of adanal papillae placed ventrally, but this could not be determined with certainty. In another specimen of *Gnathostoma* collected from the stomach of an opossum (Bur. Anim. Ind. Helm. Coll. No. 26831), only the four pairs of lateral papillae can be made out with certainty. In the number of caudal papillae our specimen agrees with *Gnathostoma spinigerum* and *Gnathostoma gracile*. It differs from the former in size, in the character and location of the spines, and in the size of the small spicule; it differs from the latter in the character of the spines.

This nematode, of which only two males were available for study, has been called *Gnathostoma turgidum* provisionally in spite of the difference here noted. When more material becomes available it may be possible to determine whether the number and position of the caudal papillae are sufficiently constant to serve as specific characters of a new species.

The remainder of the parasitic material collected from the opossum consists of nematodes, trematodes, cestodes, and fleas.

The nematodes are *Physaloptera turgida*, *Cruzia tentaculata*, *Oesophagostomum* sp., *Trichostrongylus* sp., and *Trichuris* sp. Of the last three, only females were collected, and no specific determination has been attempted.

The trematodes are *Neodiplostomum lucidum*, *Harmostomum* sp., *Rhopalias* sp., and *Echinostomum* sp. These were identified by Dr. E. W. Price, of the zoological division.

The cestodes are *Mesocestoides* sp.

The fleas were determined by Dr. H. E. Ewing, of the Bureau of Entomology, as *Rhopalopsyllus gwyni*, a species of a neotropical genus, of which only a few records have been made in the southern part of the United States.

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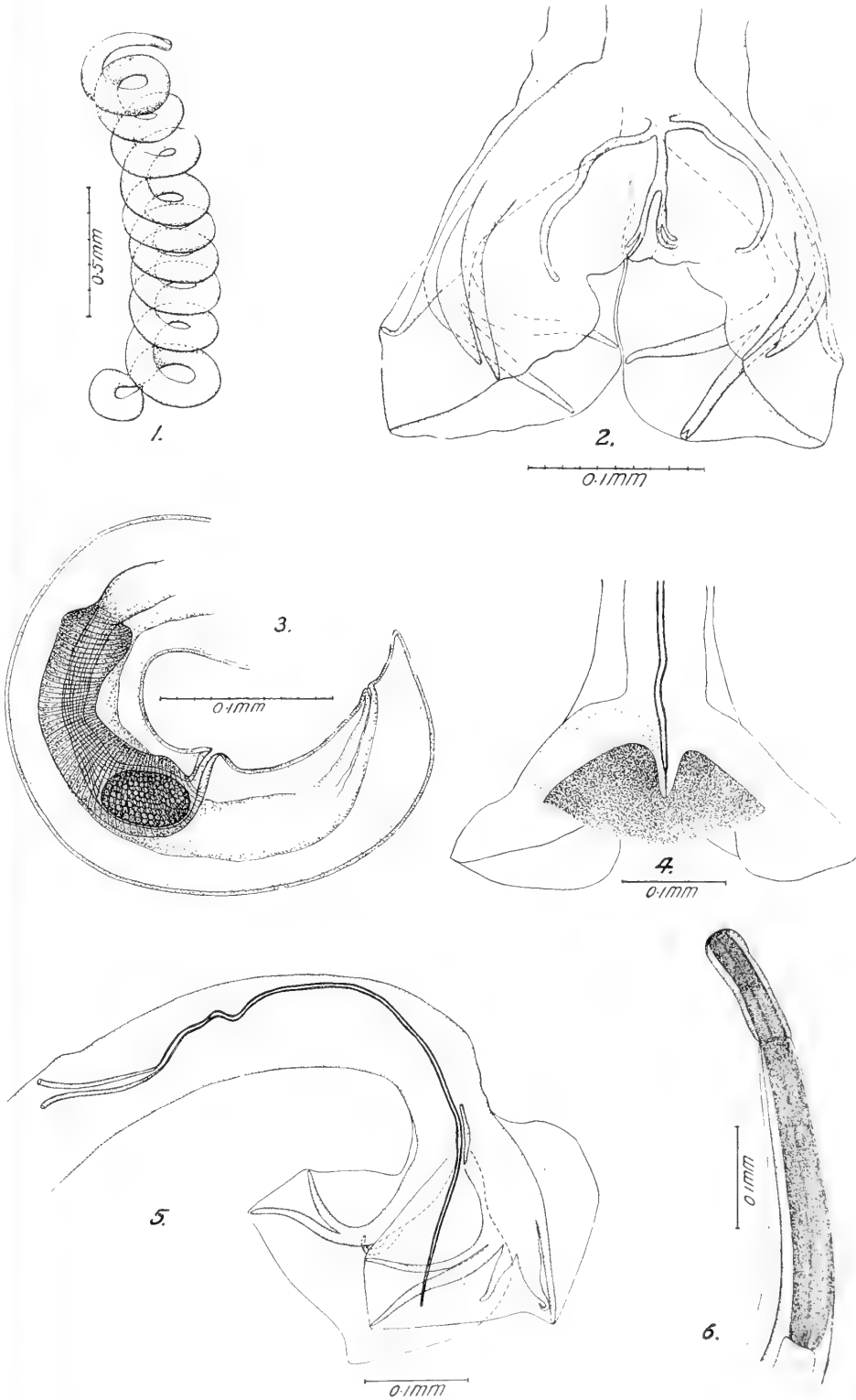
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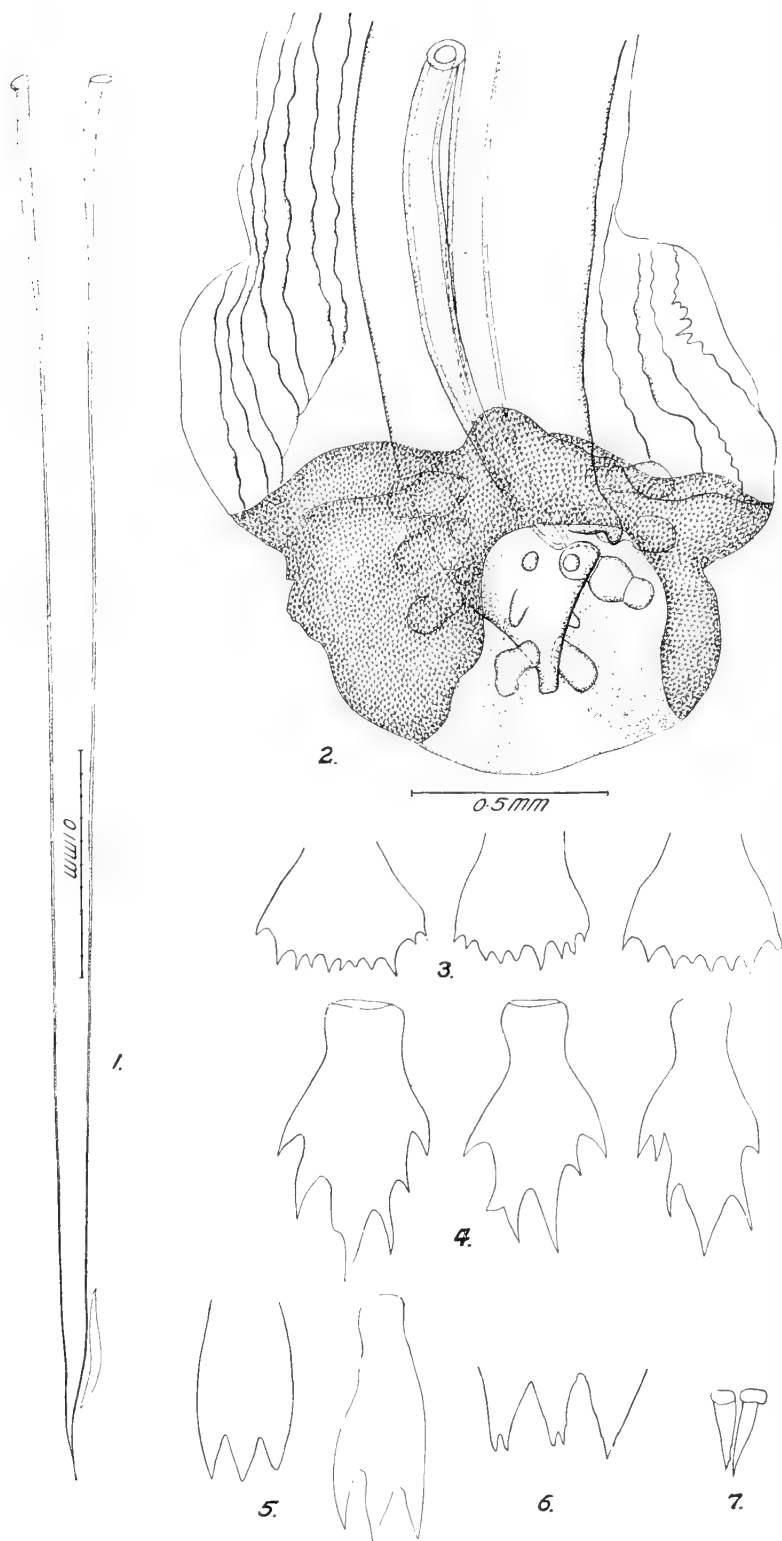
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VIANNAIA BURSOBSCURA

1, Female; 2, bursa of male, dorsal view; 3, tail end of female; 4, bursa of male showing structure within bursa; 5, tail end of male showing spicules; 6, esophagus.



VIANNAIA BURSOBSCURA AND GNATHOSTOMA TURGIDUM

1, Spicules and gubernaculum of *V. bursobscura*; 2, tail end of *G. turgidum*; 3, *G. turgidum*, body spines immediately behind head; 4, *G. turgidum*, body spines at end of esophagus; 5-7, *G. turgidum*, body spines near and at end of spinous area.

## EXCAVATIONS AT A PREHISTORIC INDIAN VILLAGE SITE IN MISSISSIPPI

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Archeological work in the Southern States has in the past been confined almost exclusively to the excavation of Indian mounds. As these are the most imposing aboriginal remains of the region, it is natural that they should have received first attention. But there are other remains—Indian village sites—which promise to yield data that will be of considerable value when Southeastern archeology comes finally to be synthesized and interpreted. Due to the obliterating effects of white civilization there is little left to mark the site of the average prehistoric Indian village in the Southeast; usually only a scattering of pottery fragments and stone implements on the surface of the ground. It happens, however, that pottery is the most valuable single criterion for determining the relationships of tribal or regional groups; when, in addition, there is also the possibility of finding traces of ancient habitations, the importance of such village sites is apparent.

In December, 1929, at the request of Dr. Dunbar Rowland, director of the Mississippi Department of Archives and History, I was detailed by the Bureau of American Ethnology to cooperate with the department in the excavation of an old Indian village site in Yazoo County. The site had been located by Dr. Rowland's representatives, Messrs. Moreau B. Chambers and James A. Ford, with whom I became associated in the work which is outlined below.

Owing to an unusual snowstorm, which left the ground in a soggy condition, we were unable to work longer than a week, but late in the following December we returned and spent three days in further excavation. The site is 1 mile west of Deasonville on the Yazoo City Highway and is located on the property of Mr. Claude H. Pepper in the SE.  $\frac{1}{4}$ , sec. 17, T. 11, R. 2 E. We are indebted to Mr. Pepper for granting us full permission to excavate and also to Mr. Homer Beall, of Deasonville, who rendered valuable assistance.

Half a mile to the north of the village site is a small mound and half a mile beyond it five other mounds. Several of these had been dug into by treasure seekers and some were further tested by us. However, they proved to have been constructed of unstratified clay and no artifact of any kind, not even a potsherd, was found. The land on which the mounds are located is low and subject to overflow, so that if village-site material occurred about them it has long since been covered over by alluvial deposits. It is not known, therefore, what relation, if any, the mounds had to the village site in Mr. Pepper's field.

The site of the old village is now a cotton field, in which at intervals young pecan trees have been set out. Excavations were confined to the section of the field where potsherds and flint implements were most plentiful, about 150 feet south of the road and 100 to 200 feet west of a 6-foot bank which marks the dividing line between the slightly higher land on which the village was located and the lower land bordering a small near-by stream known as Ellison's Creek. At the first place we dug, the village refuse did not extend below the plowed ground, although a veritable maze of post holes was found sunk into the undisturbed yellow clay subsoil. Some of these post holes were arranged in lines but the ground was so honeycombed with others seemingly placed at random in every possible position that we were not able in the short time at our disposal to extend the excavation sufficiently to see what had been the outline of the structures represented.

#### HOUSE RING NO. 1

A few yards to the eastward, however, we found an accumulation consisting of rich black earth containing potsherds, animal bones, and other refuse extending to an average depth of  $2\frac{1}{2}$  feet. A little digging showed that the accumulation was held in a trench, averaging 19 inches wide, sunk into the clay subsoil. Following this along by shoveling off the plowed surface soil it was seen that the trench curved regularly and took the shape of an almost perfect circle slightly more than 60 feet in diameter. A mule team and scraper were then obtained and all of the loose plowed earth was removed from within and around the circle. When the surface of the undisturbed subsoil had been exposed in this way it was found that instead of one circle there were three, and in addition a number of post holes, the circles and post holes all being filled with the rich black earth and refuse of the village site. As at the first place we had dug, many of the post holes here were also irregularly placed, but some, at about the center of the outer circle, were seen to be definitely arranged in a square. In addition there were numerous

other post holes at more or less regular intervals within the trenches, extending through the refuse and into the clay subsoil below.

An outline of the trenches and post holes is shown in Figure 1. The outer trench, C, averaged 19 inches in width, although at some

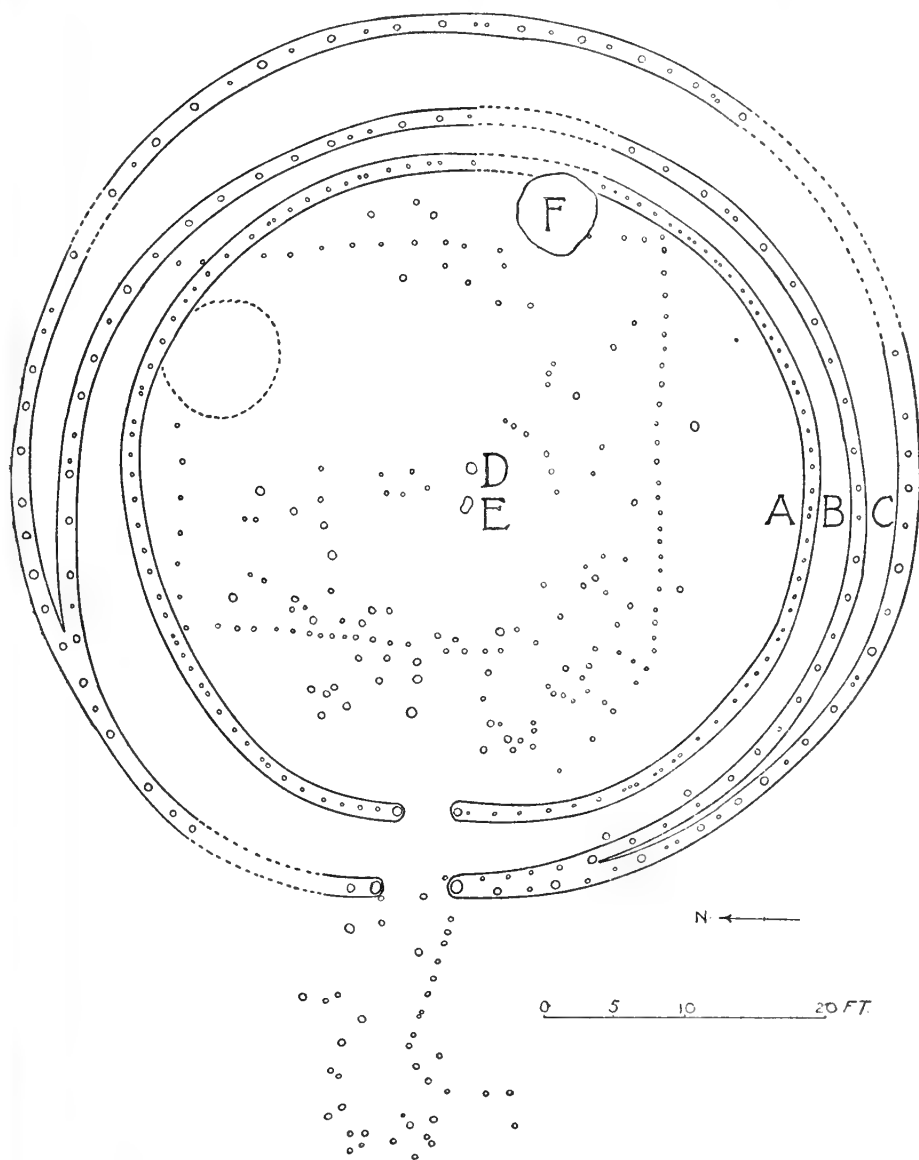


FIGURE 1.—Plan of House Ring No. 1. Broken lines indicate unexcavated areas

places it was as wide as 25 inches. It was filled throughout with rich black earth containing quantities of potsherds, animal bones, and mussel shells; the shells of the small box terrapin (*Terrapene carolina* Lin.) were especially numerous. Extending below the bottom of the trench for a total depth of more than 3 feet (including

the 2½-foot depth of the trench) was a regular series of post holes, as shown on the plan (fig. 1). The larger holes, spaced usually about 5 feet apart, were 12 to 15 inches in diameter. Between these were one and sometimes two smaller post holes, averaging 6 inches in diameter. On the west side was a break in the trench 5 feet wide, representing the entrance, where two posts larger than usual had been set up. In front of the opening, on the outside of the circle, were other post holes arranged as shown on the plan, apparently the remains of an entrance structure of some kind.

On the south side of the trench was found the flexed skeleton of a child, the skull of which had been destroyed a few years earlier when excavation for a pecan tree had been made.

Within the outer trench were two other trenches, A and B, one of which, B, joined the outer trench on the west side. At the line of junction of the two trenches on the south side of the entrance the inner wall of C continued to be traceable through the refuse of B, indicating that the outer trench C had been dug at a later time. The second trench B was smaller than C, being about 15 inches wide and 16 inches deep. Extending through the refuse of the trench and into the clay bottom for about 6 inches were both large and small post holes, 8 to 12 inches in diameter, and spaced about 4 feet apart. These post holes continued on the south side of the entrance, but not on the north side, paralleling those in the outer trench to the entrance even though the trench itself had been annexed by the larger outer one. The smaller trench B contained what appeared to be an intentional fill, consisting of mixed material—clay and black earth—with clay predominating, and an occasional potsherd or animal bone. Through this mixed fill the post holes could be easily traced, for they contained softer, blacker soil than the rest of the trench. This could not be done in the case of the larger outer trench, for there the entire fill was of such soft black material that the post holes afforded no contrast and so could not be detected until the bottom of the trench was reached. A and B, containing mixed earth, had apparently been refilled very soon after having been dug, with clay from the excavation and refuse from the surface. This would account for the scarcity of potsherds and other refuse contained in these two trenches. It might be thought that trench C, containing only soft black material, had likewise received an intentional fill but of surface refuse entirely instead of refuse mixed with clay as in the case of A and B. However, when we consider that the trench held a richer content of potsherds, shells, and animal bones than was characteristic of the surface refuse generally, a better explanation seems to be that the trench had remained open after the posts were set up in the bottom of it and that it became gradually filled with refuse during the occupancy of the house.

The inner trench A, which was 16 to 25 inches from B, was of about the same width, but was slightly shallower, being only 12 inches deep. Like B, it contained a fill of mixed clay and black earth in which the post holes, containing softer and blacker material, were clearly distinguishable. Unlike the post holes in B, these were of a uniform size, 6 to 8 inches in diameter and about 2 feet deep. They were placed from 6 inches to 2 feet apart in no regular order. On the west side was a break in the trench 5 feet wide, representing the entrance, and corresponding exactly with the entrance in C. Here again large post holes, 14 inches in diameter, were found.

Within the inner circle A was a square outlined by four rows of post holes 6 to 8 inches in diameter and placed 8 to 16 inches apart. Within the square and almost exactly at the center of the outer circle C was a large post hole, D, 15 inches in diameter and 22 inches deep. Just to the west of it was a somewhat larger and more irregularly shaped pit, E, 19 inches wide and 30 inches deep. This seemed to have been a small fire pit, for it contained an almost solid fill of ashes and refuse. Extending partly into the inner trench A on the east side was a much larger fire pit, F, approximately circular in outline and about 6 feet in diameter. It extended also over the row of post holes outlining the square inclosure. The fire pit was about 2 feet deep and was filled mostly with ashes, soil, and refuse.

Both within and without the square inclosure were numerous post holes, placed at random as indicated on the plan.

#### HOUSE RING NO. 2

Two other house rings were excavated at the Deasonville site. No. 2, shown in Figure 2, was 27 feet north-northwest of No. 1. It was 45 feet in diameter with an opening 40 inches wide on the west side. Like the two inner trenches of House Ring No. 1, it contained a mixture of rich black earth and clay. The trench had an average width of 16 inches but was very shallow, no more than 3 inches at the deepest part. This was along the eastern periphery, from which point the trench gradually decreased in depth until at the northwest side it disappeared entirely, being traceable only by the post holes which, sunk into the subsoil, continued across the break. The reduction of the trench and its total disappearance at this one place is due to water erosion, which has produced a general lowering of this section of the field.

The post holes in the bottom of the trench were placed about 3 feet apart and were of a uniform size, about 6 inches in diameter and 16 inches deep.

Within the circular inclosure was a square outlined by post holes as shown on the plan. These were of the same size and depth as

those in the trench; the post holes which should have completed the square at the southeastern corner were lacking.

Within the circular trench, as shown on the plan, was the arc of an inner circle also containing post holes.

Three fire pits, A, B, and C, were found, containing ashes, black earth, and refuse. A post hole, full of ashes, was found beneath C, the fire pit near the entrance.

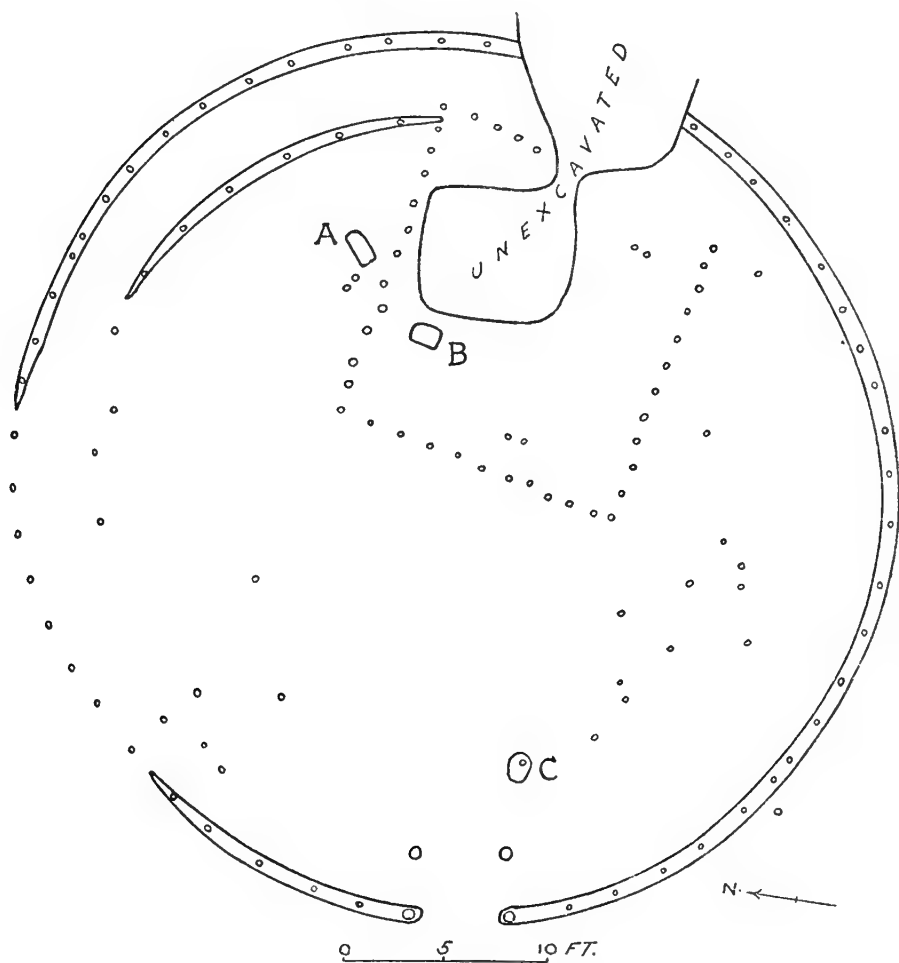


FIGURE 2.—Plan of House Ring No. 2

The positions of random post holes are indicated on the plan. There was no large central post hole as in House Ring No. 1.

### HOUSE RING NO. 3

Seventy-eight feet northeast of No. 1 and 75 feet east of No. 2 was House Ring No. 3 (fig. 3). The circle was small, being only 38 feet in diameter, and the trench was only 10 to 12 inches wide and from 2 to 4 inches deep; its fill was similar to that of House Ring No. 2.



On the northeast side the trench lies at a slightly lower slope and a part of it has been so completely eroded as to remove even the deeply sunk post holes. These were usually 3 feet apart; their average diameter was 6 inches and depth 12 to 24 inches.

The entrance, represented by a break in the trench 38 inches wide, was on the western periphery, a little south of west.

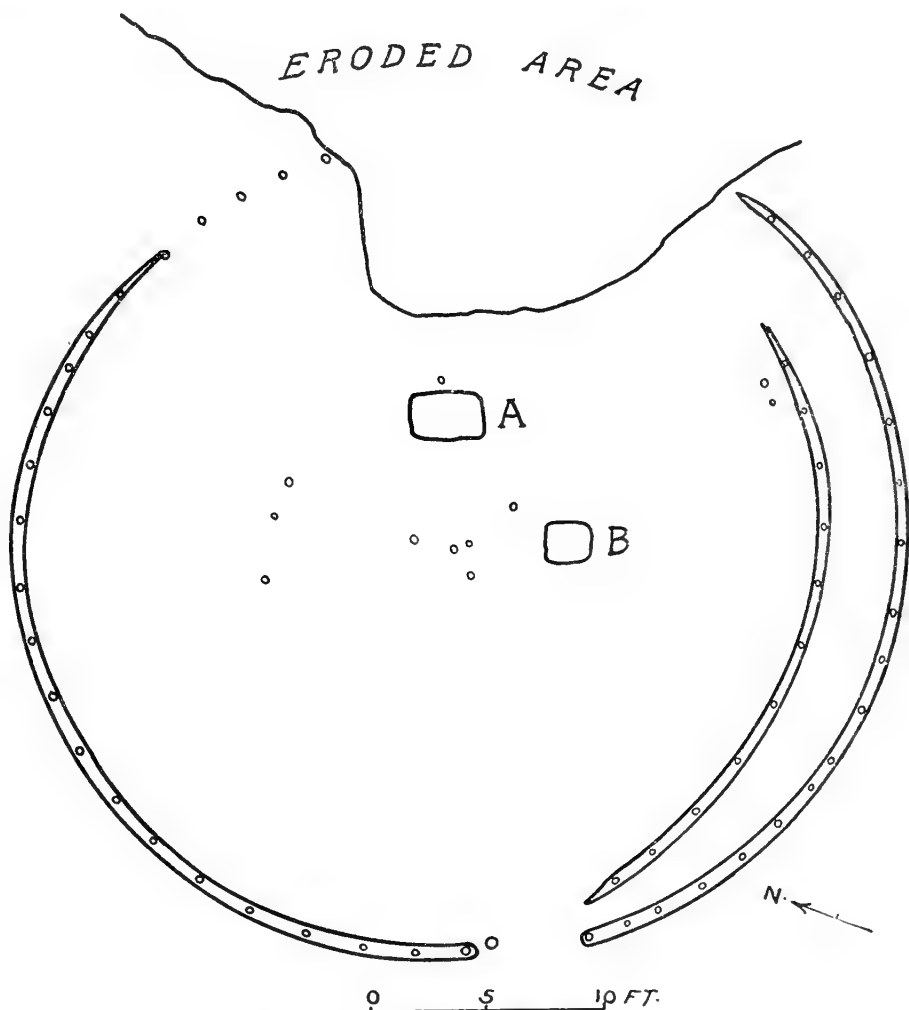


FIGURE 3.—Plan of House Ring No. 3

As in No. 2, there was found a short incomplete section of an inner trench of the same width as the outer one and containing post holes of the usual dimensions.

A rectangular fire pit, A, was 50 inches long, 26 inches wide, and 3 inches deep. B was a smaller but deeper pit, its dimensions being 32 by 26 inches and its depth 40 inches. Instead of ashes it was filled with mixed clay and black earth containing a few potsherds, one of which was found at the bottom.

Near the center of the circle were a few post holes as shown on the plan.

#### PROBABLE NATURE OF THE HOUSES REPRESENTED

Having described the trenches and post holes of the three house rings as they appear at the present time, it will be in order to attempt an interpretation or reconstruction of the dwellings of which they are the remains.

In one important respect the Deasonville house circles are unique, the posts being set up in the bottom of trenches instead of on the level surface. Trenches of this kind have not been reported archaeologically from the region, nor are they referred to in any descriptions of historic Indian structures. Especially remarkable is the fact that the large outer trench C of House Ring No. 1 seems to have remained open and only gradually became filled with refuse. It is difficult to see what purpose could have been served by such an arrangement. The possibility that this trench with its row of posts might have been a stockade seems unlikely for the reason that the posts were spaced too far apart.

The two smaller house rings, Nos. 2 and 3, are apparently the remains of simple circular habitations, the floors of which, above the clay subsoil, had been destroyed by plowing. The fact that an inner square was not found in No. 3 suggests the possibility that the square in No. 2 did not form part of the circular house but might represent a separate small rectangular structure built before or after the other. Still, its position within the circle was such that it might easily have held posts which served as inner roof supports for the circular house. The small sections of inner trenches in Nos. 2 and 3 would appear to be the remains of earlier house circles.

In the larger and more complex House Ring No. 1 we are faced with a more difficult problem. Does this represent a single structure with walls or roof supports arranged in concentric circles around an inner square, or do the three rows of trenches and the inner square represent the remains of buildings constructed at different periods? It is not a question to be decided offhand, for there are facts which seem to favor both explanations. As far as historical evidence goes we might have either four separate structures or a single large structure, for among the Southeastern Indians there were single-walled houses both square and round in outline—both forms being used sometimes in the same villages—and also larger round houses with walls arranged in concentric circles not unlike those belonging to House Ring No. 1.

We will first examine the evidence which seems to indicate that the rows of post holes in House Ring No. 1 represent two or more houses. It will be recalled that on the west side, immediately to the south of the entrance, the outer trench C cut through the fill of B, which from the point of junction decreased in width until at the entrance it had practically disappeared. This shows unmistakably that C was dug later than B. In the same way, the fire pit D would appear to have been used after the walls of A and the inner square had been razed; for the sides of the pit extended into the trench A and across the line of post holes of the square. Under these conditions the fire pit could hardly have been used while either of these walls was standing but must have belonged to B or C. It might also be mentioned that very little burnt wall material (clay) was found in the fire pit, whereas a considerable amount might have been expected had the fire pit been in use while either of the walls was standing. Finally, there are no facts that run counter to the explanation of the inner square and the three circular trenches being the remains of single walls erected at different periods, while if a single complex structure is represented there is uncertainty as to which of the rows of posts was the wall and which merely roof supports. There would be need for only one wall, which would mean that three of the rows of posts had served as roof supports or for some other purpose; it is difficult to see the necessity of such a number of roof supports so close together, especially as on the west side where for a considerable distance the posts of B and C run closely parallel.

Another explanation might be that the outer trench C was a later enlargement of B and that the posts of the inner square and of A had been utilized as roof supports for the later and larger house. But a difficulty is still presented by the large fire pit, for as just noted this could hardly have been in use while the walls of the inner square and A were standing, since it extends over both, and if as therefore seems likely, the pit belonged to either B or C, then at least those posts of the square and A which were contiguous to the fire pit were not standing when C formed the wall of the house.

While the features just mentioned seem to point to the conclusion that several different buildings are represented, the fact remains that the circular trenches and the square are arranged in such an orderly fashion as to suggest a single structure or possibly a single-walled house that was later incorporated as part of a larger and more complex structure. As will be seen, there are several descriptions of Indian houses in the Southeast which had walls and roof supports arranged in much the same way as the lines of post holes in House Ring No. 1.

The closest parallels are found in Bartram's descriptions of the circular council houses of the Cherokee and Creeks. The Cherokee town house or council house at the village of Cowe, visited by Bartram in 1776, is described as follows:

The council or town-house is a large rotunda, capable of accommodating several hundred people. . . . The rotunda is constructed after the following manner: they first fix in the ground a circular range of posts or trunks of trees, about six feet high, at equal distances, which are notched at top, to receive into them from one to another, a range of beams or wall plates; within this is another circular order of very large and strong pillars, above twelve feet high, notched in like manner at top, to receive another range of wall plates; and within this is yet another or third range of stronger and higher pillars, but fewer in number, and standing at a greater distance from each other; and lastly, in the centre stands a very strong pillar, which forms the pinnacle of the building, and to which the rafters are strengthened and bound together by cross beams and laths, which sustain the roof or covering, which is a layer of bark neatly placed, and tight enough to exclude the rain, and sometimes they cast a thin superficies of earth over all. There is but one large door, which serves at the same time to admit light from without and the smoak to escape when a fire is kindled; but as there is but a small fire kept, sufficient to give light at night, and that fed with dry small sound wood divested of its bark, there is but little smoak. All around the inside of the building, betwixt the second range of pillars and the wall, is a range of cabins or sophas, consisting of two or three steps, one above or behind the other, in theatrical order, where the assembly sit or lean down; these sophas are covered with mats or carpets, very curiously made of thin splints of Ash or Oak, woven or platted together; near the great pillar in the centre the fire is kindled for light, near which the musicians seat themselves, and round about this the performers exhibit their dances and other shows at public festivals, which happen almost every night throughout the year.<sup>1</sup>

This Cherokee house is similar to House Ring No. 1 in that its posts for walls and roof supports were arranged in circular order (although in only two circles), and that it had a large central roof support. An important difference is that in the Cherokee house the posts of the outer circle, forming the wall, were small, while those of the inner circle, supporting the main weight of the roof, were larger and farther apart. In House Ring No. 1, however, the largest posts were those in the outer circle C; those in B were slightly smaller, while those of A and the inner square were still smaller and more closely placed. Assuming a single structure to be represented, this might be taken as an indication that its roof was comparatively flat, for a conical roof rising toward the center would call for heavier supports there than along the periphery, just as in the Plains earth lodges and other American houses of similar type. The Cherokee example of an elevated range of seats "one above or behind the other, in theatrical order" might possibly explain the inner circles

<sup>1</sup> Bartram, William, *Travels Through North and South Carolina, Georgia, East and West Florida*, pp. 366-367. London, 1792.

as having held pillars by which such seats or benches, as well as the roof, were supported.

Still more similar to the Deasonville house is Bartram's plan of the circular council house or rotunda of the Creeks in which there were three concentric rows of roof supports, the inner one consisting of eight posts placed around a large central pillar and two larger circles of posts between which were built rows of seats.<sup>2</sup>

Hawkins has likewise given a description of the method of constructing a circular Creek house but speaks of only two rows of posts.<sup>3</sup> From Hawkins's description, as well as the later and more detailed one by Major General Hitchcock,<sup>4</sup> we see that the roof of the Creek house, like that of the Cherokee, was supported principally by a series of heavy uprights placed near the center of the floor, an arrangement which could not have existed in the Deasonville house since there were no large post holes (except that of the single center post) anywhere near the center.

The Chickasaw of northern Mississippi also had circular winter houses, but these had sunken floors and in other structural features closely resembled the Plains type of earth lodge, while in the Deasonville houses the floors were not sunk below the surface. Choctaw houses have been described as quadrilateral, but from Adair's statement that they were exactly similar to those of the Chickasaw, we may suppose that circular winter houses were also in use. However, no adequate description of Choctaw houses exists.

The houses of the other historic Mississippi tribes furnish no parallels to House Ring No. 1; they are all described as simple, rather lightly constructed buildings, either round or square in outline, with wattlework walls. The Tunica, with their villages on the lower Yazoo River about 50 miles west of what is now Deasonville, were the nearest of the historic tribes. The following meager description of their houses has been left by Gravier, who visited them in 1700:

Their cabins are round and vaulted. They are lathed with canes and plastered with mud from bottom to top, within and without, with a good covering of straw. There is no light except by the door. . . . Their bed is of round canes, raised on 4 posts, 3 feet high, and a cane mat serves as a mattress. . . .<sup>5</sup>

The houses of the Natchez, who lived about 75 miles south of the Tunica on the Mississippi River, have been more fully described by Du Pratz, Charlevoix, and Penicaut.<sup>6</sup> The dwellings were square in

<sup>2</sup> Bartram, William, *Observations on the Creek and Cherokee Indians*. Trans. Amer. Ethnol. Soc., Vol. III, pt. 1, p. 54, 1853.

<sup>3</sup> Bushnell, D. I., jr., *Native Villages and Village Sites East of the Mississippi*. Bull. 60, Bur. Amer. Ethnol., p. 75, 1919.

<sup>4</sup> *A Traveler in Indian Territory*. Edited by Grant Foreman.. The Torch Press, Cedar Rapids, Iowa, pp. 114-115, 1930.

<sup>5</sup> Swanton, John R., *Indian Tribes of the Lower Mississippi Valley and Adjacent Coast of the Gulf of Mexico*: Bull. 43, Bur. Amer. Ethnol., p. 315, 1911.

<sup>6</sup> Swanton, John R., *op. cit.*, pp. 59-60, 159.

outline, the sides ranging in length from 15 to more than 30 feet, while the temple was rectangular, 40 feet long by 20 feet wide.

The two smaller Deasonville house rings, Nos. 2 and 3, are not difficult to explain; they might easily be the remains of houses similar to those recorded for the Tunica, the only unique feature being that the wall posts were set up in a trench. From the evidence previously given there is reason also to regard the circles of House Ring No. 1 as the remains of walls of separate buildings erected at different periods. It is only when we consider the Cherokee and Creek houses that there is presented the alternative explanation of House Ring No. 1 being a single complex structure. When it comes to choosing one or the other alternative on the basis of the present evidence no definite conclusion seems to be warranted. In view of a certain resemblance to the Cherokee and Creek council houses described by Bartram and Hawkins it seems safer to conclude that House Ring No. 1 may possibly have been such a structure, even though the bulk of the evidence favors the view that the rows of posts represent the walls of houses erected at different times. Possibly future excavations of Indian village sites in the Southeast may bring to light additional facts which may make possible a more definite and satisfactory explanation of the Deasonville circles.

## POTTERY

Potsherds were found in abundance in the trenches and post holes and on the surface of the plowed ground. In order to determine the relative proportions of the various types of ware represented, a surface collection was made by picking up every sherd on and between three cotton rows for a distance of about 100 feet. This resulted in a collection of 398 sherds, as follows:

- 238 undecorated.
- 57 cord marked.
- 50 painted.
- 47 incised.
- 4 punctate.
- 1 roulette or stamped.
- 1 small knob or rim.

These surface sherds were for the most part small, having been for many years plowed over and trampled upon. A larger collection, selected on the basis of decoration or shape, was made both from the trenches and the surface and has been utilized in the following description of the decoration, shape, paste, and color of the ware. There was no distinction between the sherds from different parts of the site; the same mixed type of pottery was found on the

surface, in the three house rings, in the post holes, and in the various sections of House Ring No. 1. The characteristics of the various types of ware will be described below in the order of their occurrence. They are also given in summarized form in Table 1.

On two complete vessels (pl. 1, *a*, *b*) have been found at the site; *a* was found in trench C, House Ring No. 1, and *b* was presented to the Mississippi Department of Archives and History by Mr. Homer Beall, who had dug it up a few years previously.

*Undecorated ware.*—Vessels of undecorated ware were either rounded bowls, of which Plate 1, *a*, is an example, or steeper-sided jars.

TABLE 1.—CHARACTERISTIC FEATURES OF DEASONVILLE POTTERY

Kinds of wares	Shapes of vessels	Paste			Surface		Decoration	Rims	
		Texture	Color	Temper	Finish	Color		Shape	Decoration
Undecorated...	Bowls and jars.	Coarse.....	Gray, black, or reddish.	Pulverized potsherds.	Usually smooth.	Drab gray or light brown.	-----	Straight or slightly incurved.	Occasionally a line on top.
Cord marked	Jars.	do.....	Buff gray, or black.	do.....	Cord marked	Light brown to dark gray.	Cord impressions.	Straight or slightly incurved (sel-dom everted).	
Painted	Conical and rounded bowls.	Fine.....	Blue-gray	Pulverized mussel shells.	Smooth	Red, white, and gray.	Alternating red and white bands and scallops.	Enlarged; slightly overhanging on both sides.	Usually painted red.
Incised (rim only).	Bowls and jars.	Coarse.....	Gray, black, or reddish.	Pulverized potsherds.	Usually smooth.	Gray or brown.	Band of lines below rim.	Straight or slightly incurving.	Occasionally a line on top.
Incised (body of vessel).	-----	Usually fine; some porous.	Light brown or gray.	Pulverized mussel shells (some vegetable fiber).	S o m e w h a t rough.	Buff or cream	Straight and curved lines over body of vessel.	Straight, incurved, and everted.	Looped handles.
Punctated	-----	do.....	do.....	do.....	do.....	do.....	Punctations, usually in bands.	Usually everted	Do.
Roulette or stamped.	-----	Fine.....	Gray.	Pulverized mussel shells.	-----	-----	Rouletted or finely stamped area inclosed by deep lines.	-----	-----



The paste is coarse and is tempered with pulverized potsherds; only an occasional sherd shows a shell tempering.

In color the paste is mainly of two shades, gray to black or reddish; firing has generally produced on the outside of the vessel a drab gray or light brown color. Both surfaces are polished to some extent. On those sherds in which the paste is of a dark color the polishing of the inner surface often produced a deep black, while the outer surface, subjected to more intense heat in firing, had been burned to a gray or brown color.

*Cord-marked ware.*—Vessels with cord-marked exteriors were mostly high, straight-sided jars, although a few lower vessels with rounded sides were also represented.

Most of the sherds are light brown in color, while others range from light gray to almost black. The inner surface is smooth and shows a black polish where the paste is of a dark color.

As in the case of the plain ware, the paste is coarse and contains ground potsherds as tempering material. In color the paste is buff, gray, or black.

The surface decoration, if it may be called such, was produced usually by means of a cord-wrapped paddle; a few sherds bear impressions of woven textiles. Typical sherds are shown in Plate 2.

*Painted ware.*—The outstanding type of decorated pottery bears bold patterns in bright red and white pigment applied to both surfaces of the vessel. (Pl. 3.)

The most common shape was a graceful jar or bowl with wide mouth and straight sides which tapered down to a small flat circular base. Shallow rounded bowls appear also to have been present, to judge from the shape of some of the sherds, although no rounded bottoms were actually found. The rim was usually formed of a more or less rounded coil of clay, overhanging on both sides. Almost invariably a line had been incised just below the overhanging rim, sometimes on one side, sometime on both sides. Other rims are merely somewhat enlarged, while a few are straight. All of the rounded rims are painted red.

In contrast to the plain and cord-marked ware the paste is of a smooth, fine texture, being tempered with finely pulverized mussel shells; its color is a light bluish or steel gray.

The decoration, as far as could be judged from the sherds, was mainly of two types. Most commonly there was a red center at the base of the vessel from which radiated red panels, narrow at the bottom and increasing in width toward the top. These were separated by fields of pure white or bluish gray. The white and red combination was the prevailing one, both colors having been applied as a heavy slip. The blue-gray color, which appears less

frequently, was not applied as a slip but was produced by polishing the fine-textured blue-gray paste. The other principal decoration consisted of broad white scallops along both sides of the rim, with the rest of the surface bearing a plain red slip. In some sherds the red slipped decoration was replaced by a light brown or chocolate.

*Incised ware.*—In the numerical distribution of the pottery types given on page 12, sherds bearing an incised decoration are for convenience all grouped together. There are, however, two clearly differentiated types into which this incised ware falls. First is a type of pottery, represented almost entirely by rim sherds, which in color, paste, and tempering material is identical with the undecorated ware previously described. It differs only in having one to four—usually two—parallel incised lines encircling the vessel immediately below the rim. Some of the sherds have also a line incised along the top of the rim. Most of the lines below the rim are somewhat deep and were made by trailing a sharp stick held straight against the side of the vessel. (Pl. 4, *d-f*, *k-m*.) In some cases, however, the implement had been held with the point toward the rim, resulting in a somewhat wider and beveled line, deeper at the top and having an “overhanging” appearance. (Pl. 4, *a-c*, *g-i*.) The possible significance of this type of decoration will be referred to later.

The body of the vessel below the rim bears no other ornamentation, so it may be regarded as certain that a number of the undecorated sherds, which are identical in color, surface finish, paste, and tempering, were from vessels having this simple incised decoration restricted to the region of the rim.

The shapes of the vessels were usually shallow rounded bowls, although a few steeper-sided jars were represented.

The second variety of incised ware (pl. 5) differs in paste, color, and tempering material, as well as surface finish and decoration. The incised lines, instead of being applied in parallel bands and only to the rims of vessels, are usually curvilinear and are applied over the surface of the vessel generally. Plate 1, *b*, one of the two whole vessels found, is an example of this type.

The color of the paste is usually a light brown or gray, to which firing has brought a more uniformly buff or cream color. The paste is of two kinds, most commonly smooth and fine textured with shell tempering, and less frequently soft and somewhat porous, having had apparently a tempering material, probably vegetable, which had been mostly destroyed in firing.

The surface finish is somewhat rough, not having been polished like the incised ware first described. In that type the surface was

relatively smooth, because polished, even though the paste and tempering material was coarse. Here the reverse is true, for the surface appears rough through lack of polishing, even though the paste and tempering is mostly of fine texture.

The sherds of this type are small and few in number, so that nothing can be learned of the vessel shapes aside from the vase shown on Plate 1.

*Punctate decoration.*—In paste, tempering material, and color this ware is identical with that just described.

Most of the punctations are arranged in bands, outlined by deeply incised lines. (Pl. 6.) The indentations are round, conical, or elongate, depending on the shape of the point used.

*Roulette or stamped decoration.*—Only two sherds of this type were found in addition to the one small example from the numbered surface collection.

The paste is smooth, gray in color, and is shell tempered.

The decoration consists of very finely stamped or rouletted areas in bands, inclosed by deeply incised broad lines. (Pl. 5, n.)

*Effigy head.*—No effigy heads were found in addition to the one from the surface collection. This was a crudely modeled head of an animal which had been applied to the rim of a vessel.

*Rim knobs and handles.*—On Plate 7 are shown examples of the handles and lugs that were attached to some of the vessels. These appear to have been restricted to vessels in which the paste was either somewhat porous or coarse and shell tempered. The surface lacks a polish and the decoration consists of incised lines (of the second variety described above) or of punctations.

*Distribution of the pottery types.*—The most important immediate problem of Southeastern archeology is to establish a basis for a chronology of prehistoric sites. From the fragmentary nature of the evidence this will have to be for the most part a disjointed and patchwork chronology, far less perfect and comprehensive than that which has been worked out in other areas, notably in the Southwest, where ruins of all periods are well preserved and where at times even such perishable materials as basketry, textiles, and wood are found, and where in addition there still exist native tribes whose customs, social structure, and economic activities continue along much the same lines as those of their direct ancestors, the builders of the prehistoric remains in the same region. The task of working out a chronology for Southeastern archeology will be much more difficult and there is therefore all the more reason for painstaking examination and study of such aboriginal remains as are still available. The obvious beginning toward such a study is to determine wherever possible the nature of the remains left behind by the historic occupants of the area, most of whom have long since dis-

appeared or been removed to reservations. Practically, this means locating exactly from historical sources the sites of old Indian villages and collecting what may be available for comparison with similar material from earlier sites of unknown age. The most valuable material for this purpose is pottery; and broken fragments, if sufficiently numerous, are very nearly as useful as whole vessels, or even more so if the latter should not happen to include the entire range of types present. In 1925, by utilizing the pioneer work of Henry S. Halbert, I was able to locate and make collections from certain historic Choctaw village sites in eastern Mississippi.<sup>7</sup> The result was the determination of the historic Choctaw type of pottery, on the basis of which comparison with pottery from sites of unknown age is now possible. A few years later similar work was undertaken for the Mississippi Department of Archives and History by Messrs. Moreau B. Chambers and James A. Ford, who were able to locate certain historic Natchez and Tunica sites in western Mississippi. In a forthcoming paper by James A. Ford the potsherds from these historic sites as well as those from neighboring older sites are to be described. Having participated to some extent in locating the Natchez site and having had an opportunity to examine the other materials found by Ford and Chambers, as well as the manuscript referred to, I am able to make use of these additional data as comparative references in the following brief summary.

Red and white painted ware was the most characteristic single type of decorated pottery found at the Deasonville site. Its occurrence elsewhere in the State seems restricted to the Mississippi River section, where it has been reported by Moore from Warren, Bolivar, and Tunica Counties.<sup>8</sup> At these sites Moore also found vessels of the same shape as some of the red and white painted bowls from Deasonville—inverted truncated cones with small circular bases, low sloping sides and very wide mouths.<sup>9</sup> Vessels bearing bold designs in red and white have been found more frequently in Arkansas, in Phillips, Lee, Crittenden, and Mississippi Counties along the Mississippi River, and they are also found on the St. Francis, Arkansas, and Red Rivers.<sup>10</sup> European material was found by Moore at several of the sites from which came the red and white painted pottery.<sup>11</sup>

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<sup>7</sup> Collins, Henry B., Jr., Potsherds from Choctaw Village Sites in Mississippi. *Jour. Wash. Acad. Sciences*, vol. 17, No. 10, pp. 259-263, May 19, 1927.

<sup>8</sup> Moore, Clarence B., Some Aboriginal Sites on Mississippi River. *Jour. Acad. Nat. Sciences*, Philadelphia, Vol. XIV, pp. 383, 387, 393-395, 412.

<sup>9</sup> Moore, Clarence B., *op. cit.*, pp. 401, 409-410, 441, 458, 476.

<sup>10</sup> Moore, Clarence B., Antiquities of the St. Francis, White, and Black Rivers, Ark. *Jour. Acad. Nat. Sciences*, Philadelphia, Vol. XIV.

Idem, Some Aboriginal Sites on Red River, *ibid.*, Vol. XIV.

Idem, Certain Mounds of Arkansas and Mississippi, *ibid.*, Vol. XIII.

<sup>11</sup> Idem, Certain Mounds of Arkansas and Mississippi, pp. 513, 525.

Idem, Some Aboriginal Sites on Mississippi River, p. 431.

In describing the incised ware from Deasonville, mention was made of the fact that some of the lines encircling the rims of vessels otherwise undecorated were applied in such a way as to have an "overhanging" appearance; that is, the lines were deeper at the top than at the bottom. (Pl. 4, *a-c*, *g-i*.) This is a style of decoration which Ford and Chambers have found to be characteristic of certain prehistoric sites in western Mississippi as distinguished from near-by historic sites of the Natchez and Tunica. The presence of this type at Deasonville is therefore of interest, although its full significance can not be understood until its entire range and the relative position it occupies elsewhere is known.

In this same connection it should also be noted that the Deasonville sherds contained no examples of historic Choctaw ware, which is characterized by straight or curving bands of very fine lines applied with a comblike implement;<sup>12</sup> or of Tunica ware in which the decoration consists of somewhat enlarged rims bearing indentations or scallops together with a single encircling line along the top. Typical Natchez pottery with its usually polished surface and scroll or meander decoration is also absent at Deasonville, although some of the incised ware of the second variety (rough surfaced, shell tempered, and sometimes soft and porous) bears a curved line ornamentation of this general type. (Pl. 5.)

The Deasonville collection includes three sherds, which despite their small number are of especial interest. These bear a decoration consisting of finely stamped or rouletted bands outlined by deeply and broadly incised lines. (Pl. 5, *n*.) I have found this style of decoration at Pecan Island, in southwestern Louisiana, and Moore has found it in Sharkey County, Miss., on the Mississippi River.<sup>13</sup> It is also a design which occurs typically on the pottery of the highly developed Hopewell culture of Ohio.

Study of the potsherds from Deasonville fails to reveal any clues which might be of value as showing the chronological position of the site beyond the mere fact that it is prehistoric. Thus the absence of pottery types definitely attributable to the historic Choctaw, Tunica, or Natchez (as well as the absence of metal or other European material), and the presence of another type which at other Mississippi sites appears just as definitely prehistoric, places the Deasonville site in the latter category. This is a conclusion which might have been expected in view of the fact that Deasonville is in an area not known to have been inhabited by any historic tribe but lies between the territories formerly occupied by the Choctaw on the east and the Tunica and Yazoo on the west.

<sup>12</sup> Collins, Henry B., jr., op. cit.

<sup>13</sup> Moore, Clarence B., *Certain Mounds of Arkansas and Mississippi*, p. 587.

As for the spatial distribution of the ceramic types represented, all that can be said is that the affinities of those which are sufficiently distinct to have a correlative value appear to be with the West—western Mississippi, Arkansas, Louisiana—rather than with Alabama or Florida. While it is to be regretted that the conclusions arrived at are so indefinite, the nature of the material available for comparison precludes for the present any more exact interpretations. We must know, for instance, much more about the geographical range of the various types of Southeastern pottery and the relative position occupied by each, and especially we must know which types are found associated with European material and which types are never found in such association. Eventually, no doubt, these things will be known and it will be a comparatively simple matter to assign newly found material to its proper position. Meanwhile, the Deasonville sherds are presented descriptively until such time as interpretations may be in order.

*Bone implements.*—The only bone implements found were awls and scrapers. In Plate 8, *a*, is shown a rather blunt pointed awl of antler; *d* is made from the ulna of a deer, and *e*, *f*, and *g* from a piece of deer leg bone, antler, and bird bone, respectively; *b* and *c* of the same plate are scrapers fashioned from the metapodial bones of deer.

*Stone implements.*—Flint implements, weapons, unfinished pieces and fragments were found in abundance. Plate 9, *a*, is probably an unfinished knife blade and *b* an unfinished scraper; *c* shows a scraper made from petrified wood and *d* and *e* are scrapers of flint. Two knife blades are represented in *f* and *g*. Projectile points in a variety of shapes and sizes are shown on the same plate, *h* to *v*.

Hammerstones of more or less rounded shape with a central depression for a finger grip were present in considerable numbers. Typical examples are shown on Plate 10, *a-e*.

On Plate 10, *f*, is shown a small polished celt or ax of quartzite.

*Tobacco pipes.*—Fragments of three tobacco pipes of the common elbow shape were found, an example of which is shown on Plate 11, *a*.

*Miscellaneous.*—Plate 11, *b*, represents a small pottery object of mushroom shape. These objects are usually referred to either as smoothing implements for use in pottery making or as stoppers for narrow-mouthed jars. The former explanation appears more applicable in the present case, since narrow-necked jars do not seem to have been represented among the Deasonville pottery forms.

In *c-e* are shown three small disks fashioned from potsherds and used no doubt in the same way as *b*; *f* is a rounded sandstone pebble, also probably used as a pottery smoother.

In *g* is shown a piece of fire-burned clay from a house wall, with clearly visible impressions made by the split canes over which the clay had been daubed.

*Charred corncobs*.—In some of the post holes which contained charcoal and ashes, pieces of charred corncobs were found. (Pl. 11, *h-m*.) These were submitted for examination to Dr. G. N. Collins, of the Department of Agriculture, a foremost authority on maize, who has kindly submitted the following statement:

The specimens of maize are pieces of cobs of 12-rowed ears. The cobs are small for 12-rowed ears. Of the modern varieties grown by the North American Indians, all that we have seen with such small cobs have only 8 rows of seed. The only types with small cobs and more than 8 rows with which we are familiar are from Peru.

The best preserved of the Mississippi specimens has very prominent glumes resembling in this particular specimens from the caves of the Ozark Mountains.

No statements are warranted regarding the antiquity or primitive nature of the types represented by any of the specimens. It should be kept in mind, in this connection, that the early stages in domestication and improvement of maize are unknown. Prehistoric examples may differ from modern types but it may not be said they are more primitive.

#### ANIMAL REMAINS

In the trenches and post holes were found quantities of the bones and shells of animals that had been eaten by the Indians. Many of the mammal bones had been split and broken to obtain the marrow, and some had been burned. The animal remains, in order of their relative abundance, occurred as follows: Mammal bones, mollusk shells, turtle shells, bird bones, fish bones. For the identification of the animal remains I am indebted to Dr. Leonhard Stejneger, Dr. Herbert Freidmann, Messrs. H. H. Shamel, W. B. Marshall, and E. D. Reid, all of the United States National Museum.

To judge from the relatively great number of deer bones (*Odocoileus virginianus louisianae*), this was the most common food animal. Other forms represented were: Beaver (*Castor canadensis*), raccoon (*Procyon lotor*), black bear (*Euarctos americanus*), gray fox (*Urocyon cinereoargenteus*), opossum (*Didelphis virginiana pigra*), skunk (*Mephitis mesomelas*), bob cat (*Lynx rufus*). No dog bones were found.

Fresh-water mussel shells were fairly abundant. The common form was *Plectomerus trapezoides*, with some representatives of the genus *Lampsilis*.

Large numbers of unbroken turtle carapaces were found in the trenches. These were of the small box turtle (*Terrapene carolina* Lin.). Others represented by shell fragments were the soft-shelled turtle (*Amyda spinifera* Le Sueur), the snapping turtle (*Chelydra serpentina* Lin.), and a slider (*Pseudemys* sp.).

Very few bird bones were found, due no doubt in part to the fact that being fragile they were not preserved, although birds were probably never a very common article of diet in this region. The only bird bones found were the comparatively large and heavy wing and leg bones of the wild turkey (*Meleagris gallapavo*.)

The only fish bones found were mandibles of the gar pike (*Lepisosteus osseus* Lin.). The absence of other fish bones may almost certainly be attributed to their extremely fragile nature, which makes them, of all animal bones, the least adapted to preservation.



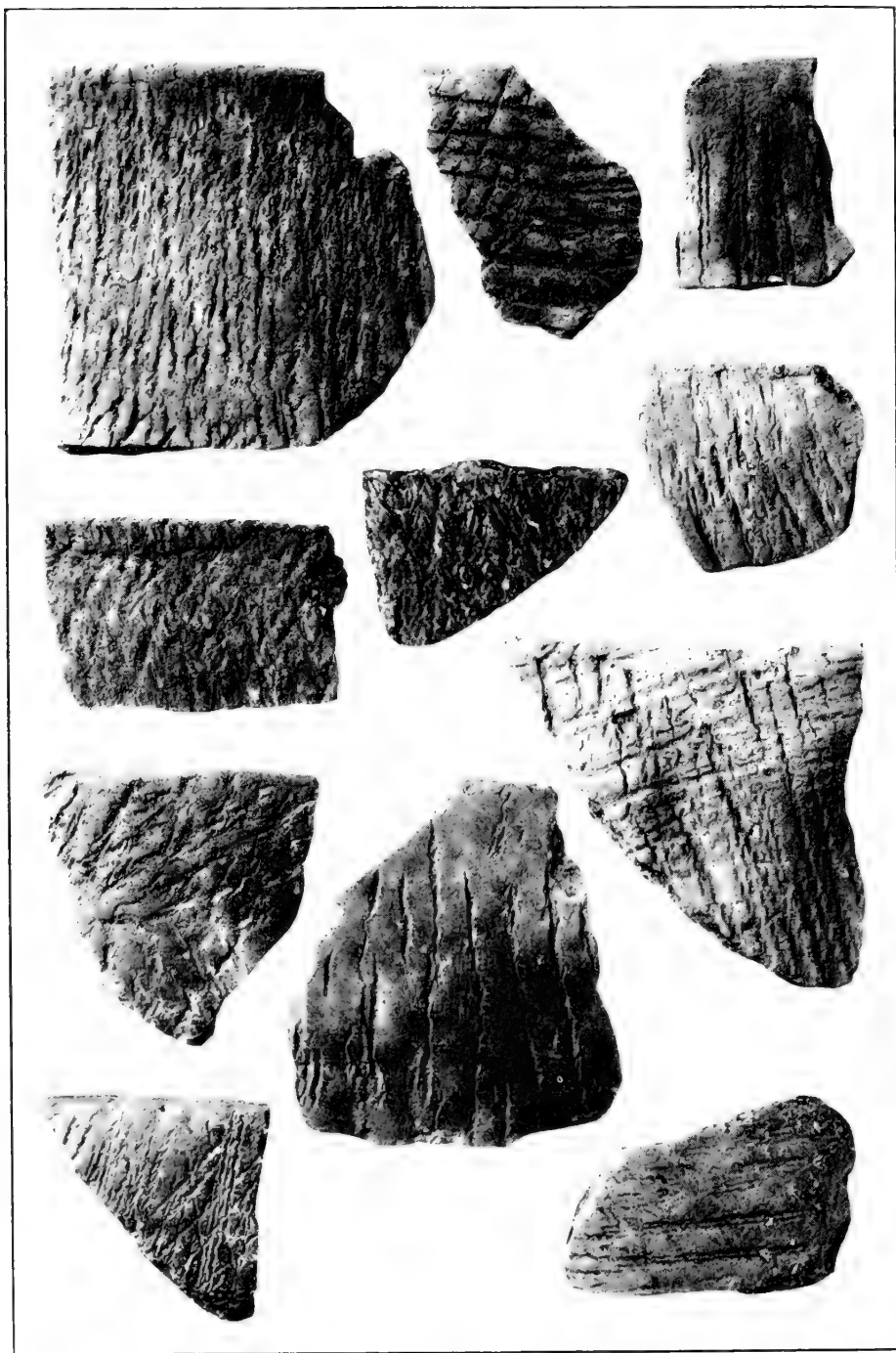


*a*

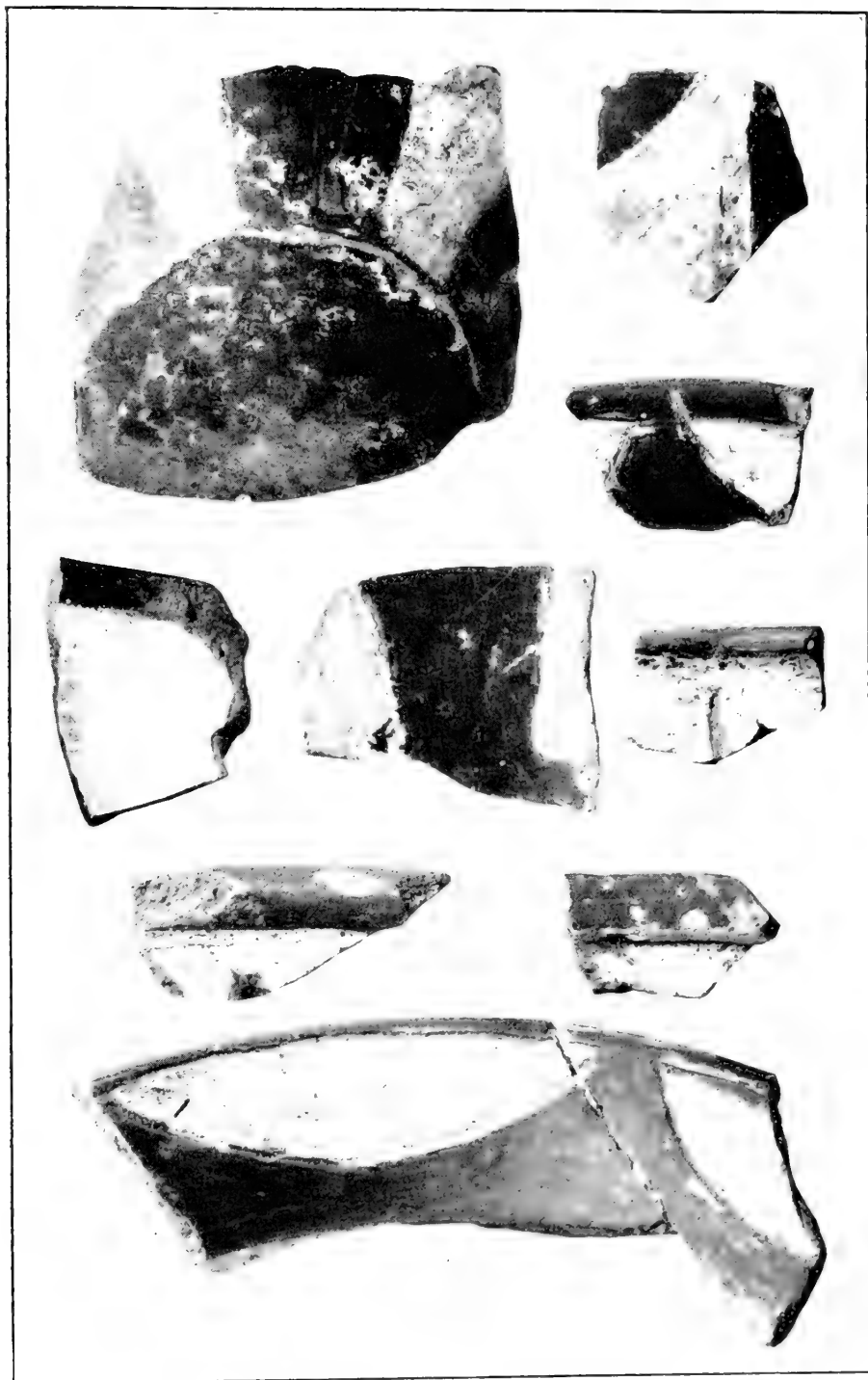


*b*

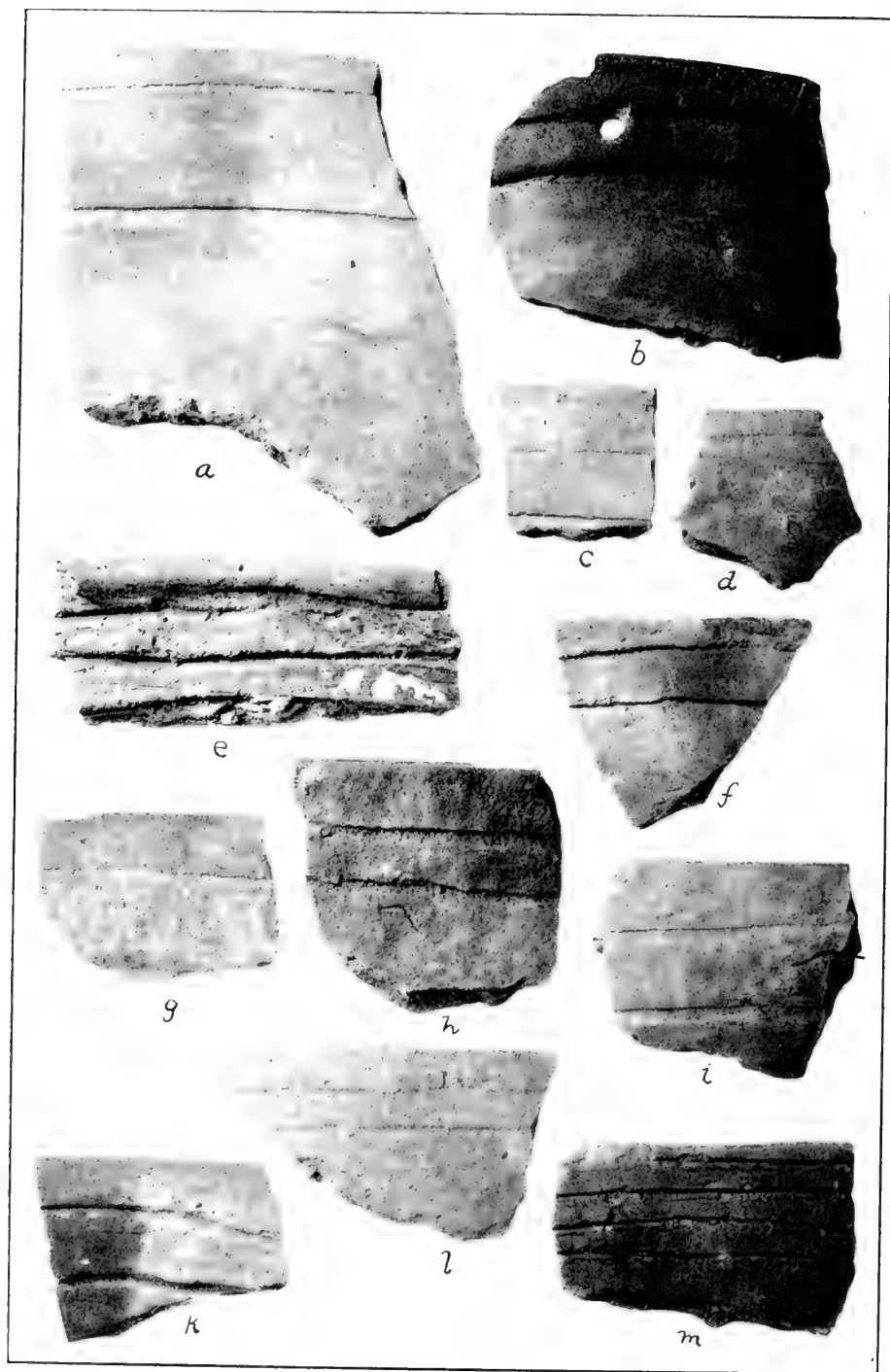
VESSELS FROM THE DEASONVILLE SITE



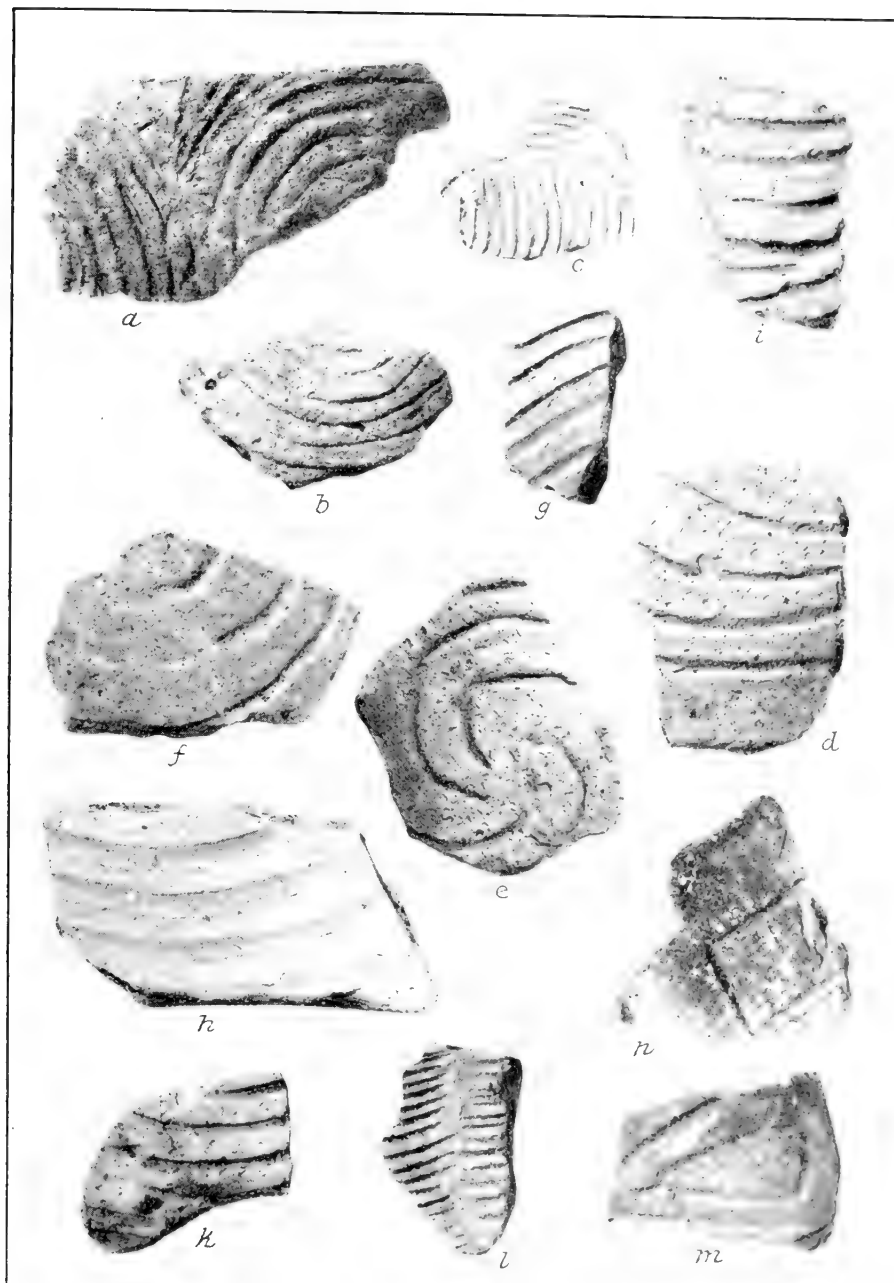
POTSHERDS SHOWING CORD-MARKED EXTERIORS



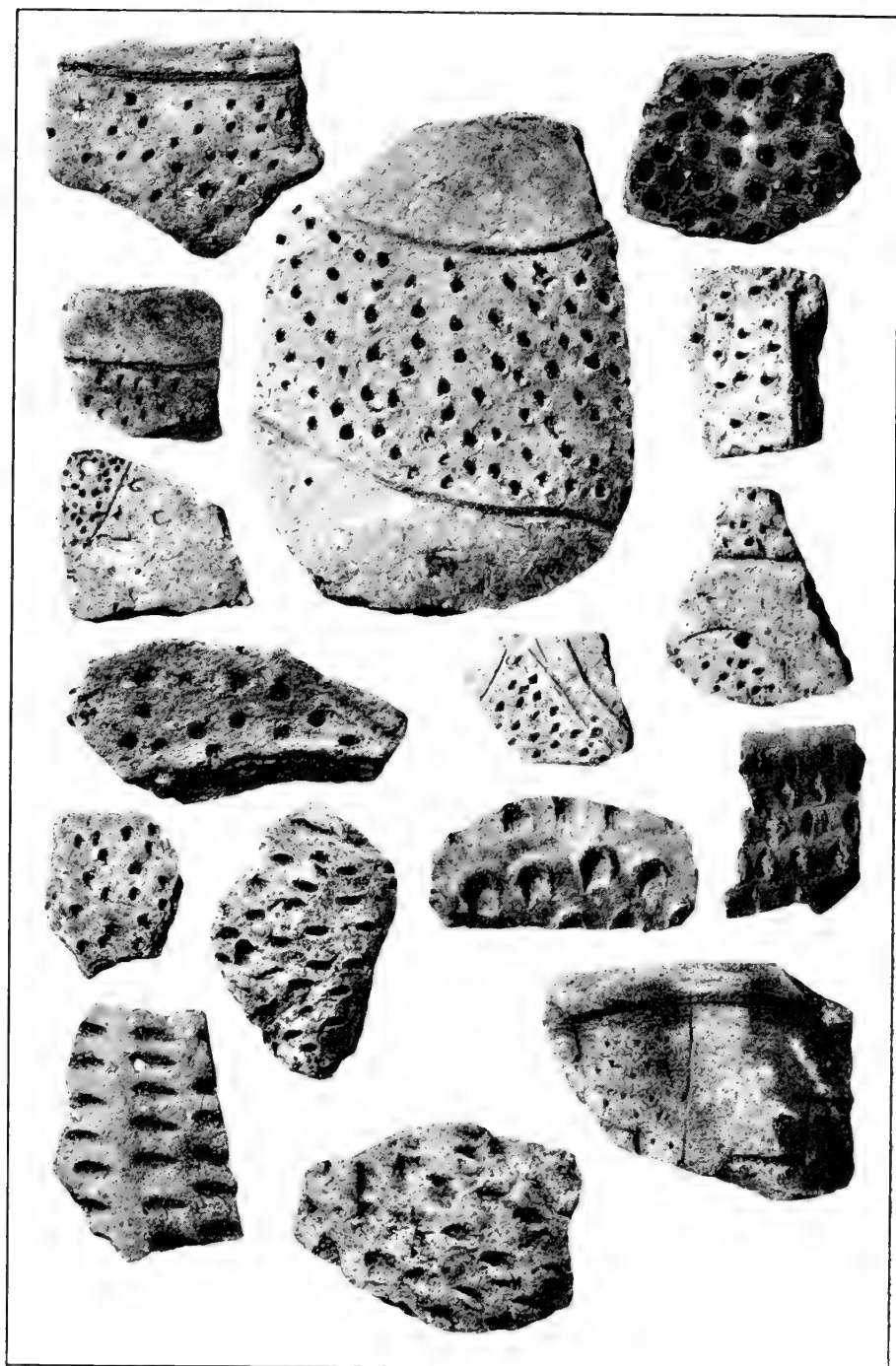
POTSHERDS WITH BOLD DESIGNS IN RED AND WHITE PIGMENT



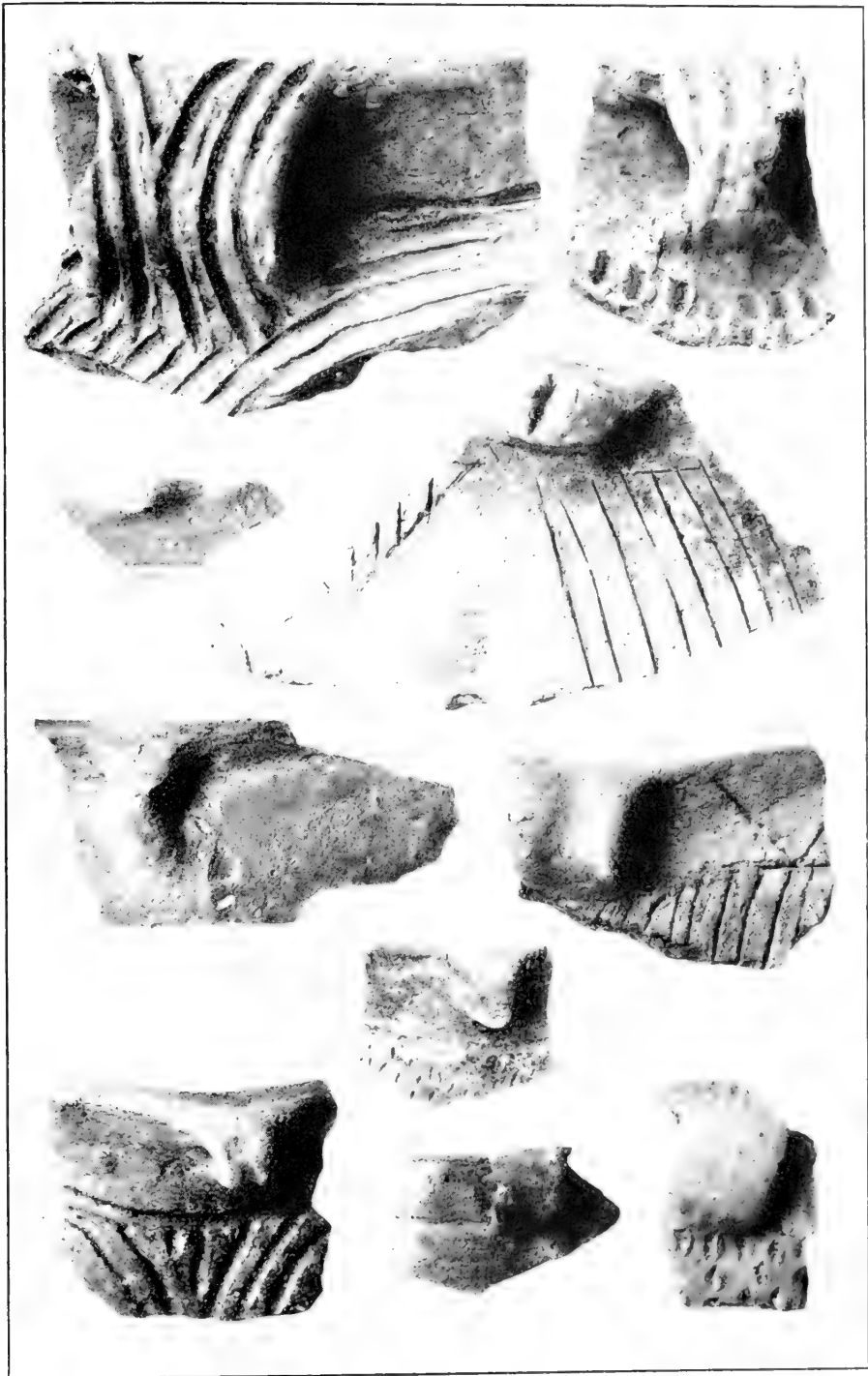
POTSHERDS WITH INCISED LINES AT RIMS



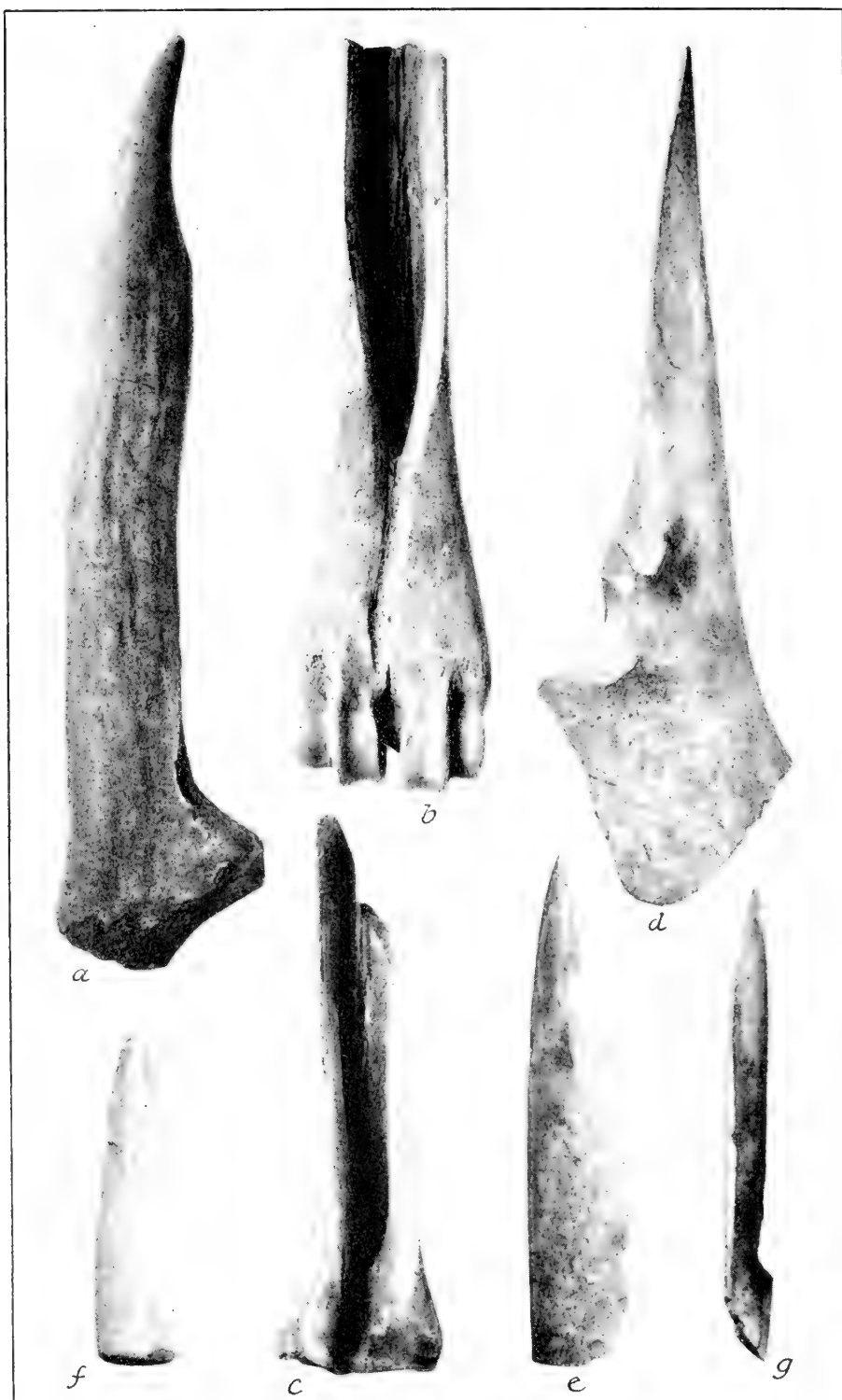
POTSHERDS SHOWING INCISED DECORATION OVER BODY OF VESSEL



POTSHERDS WITH PUNCTATE ORNAMENTATION

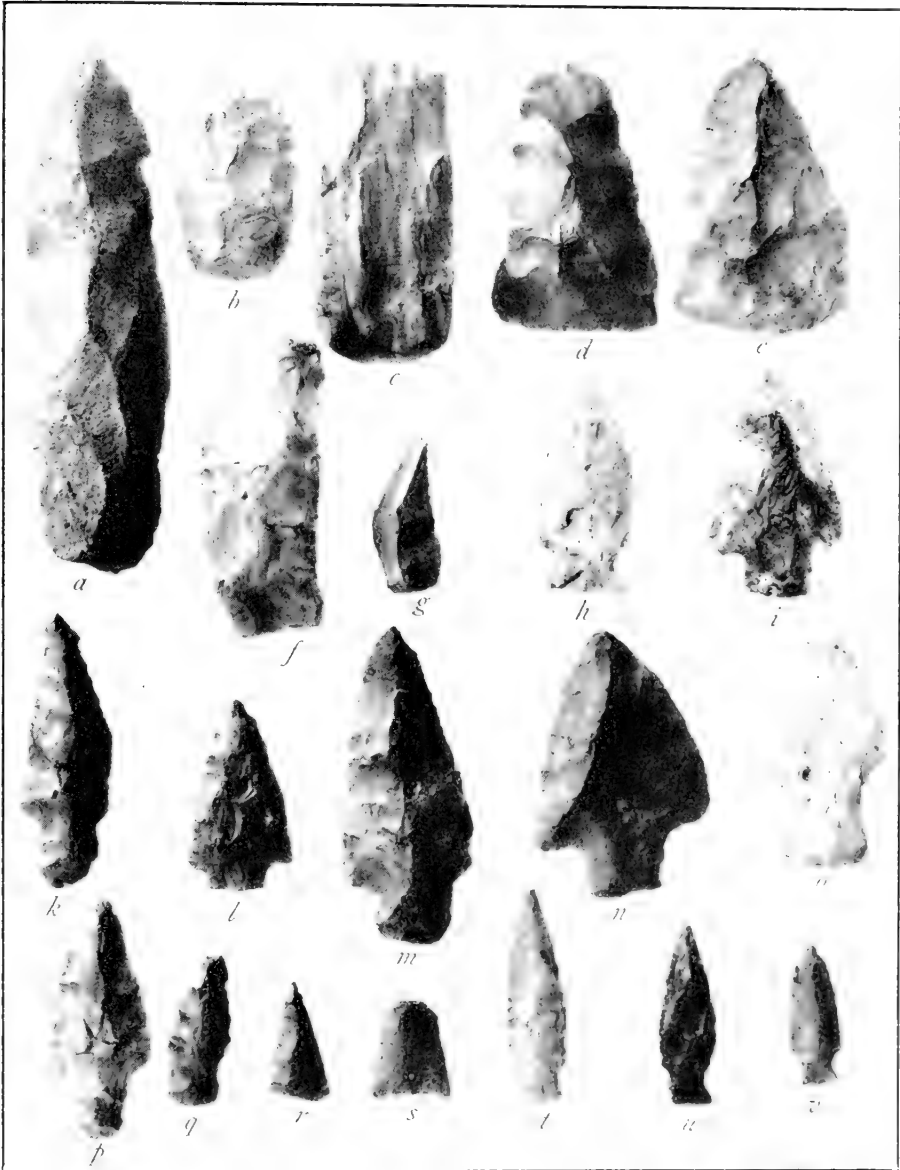


EXAMPLES OF HANDLES AND LUGS ON POTTERY

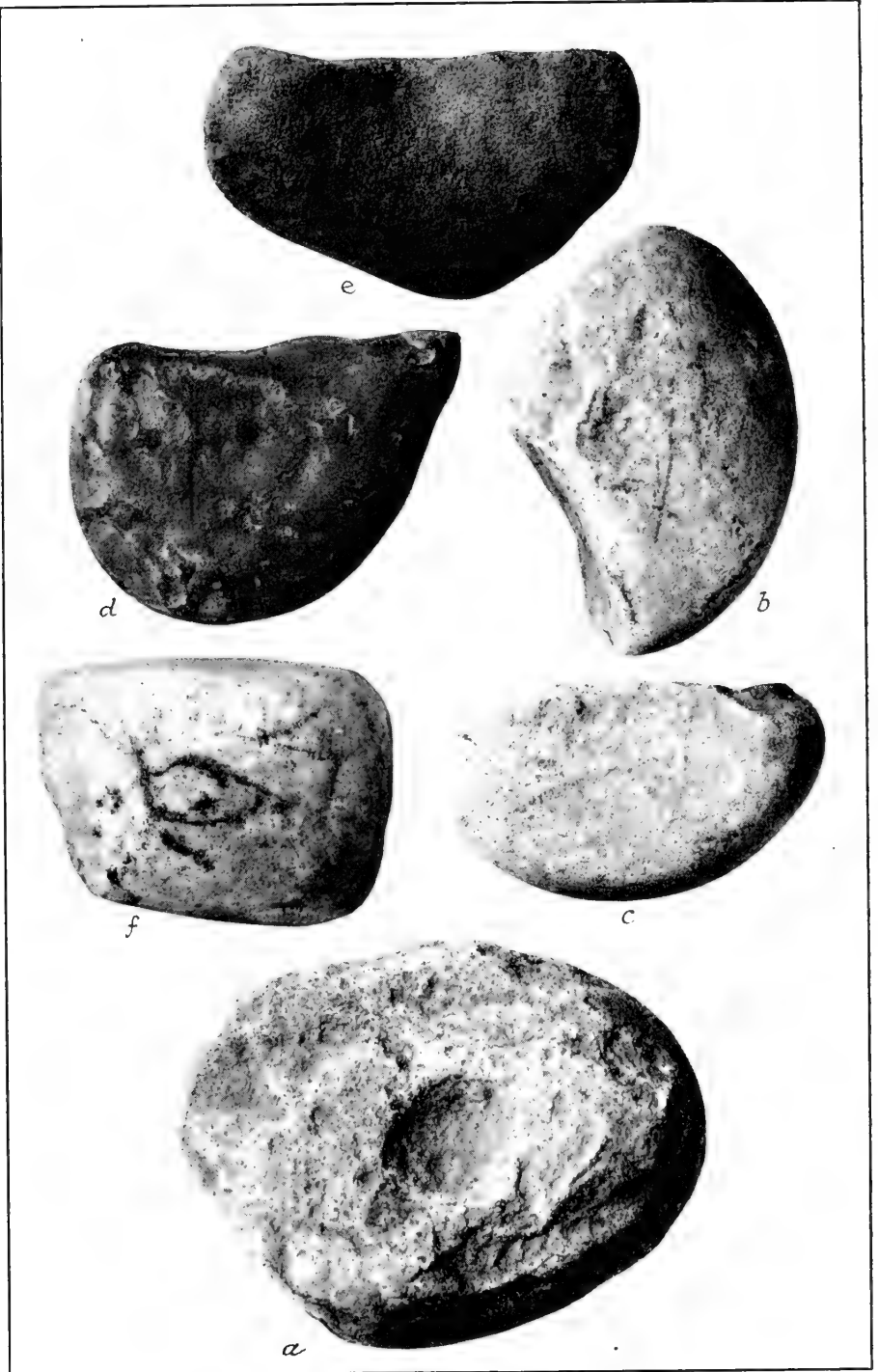


AWLS AND SCRAPERS MADE OF ANTLER AND BONE

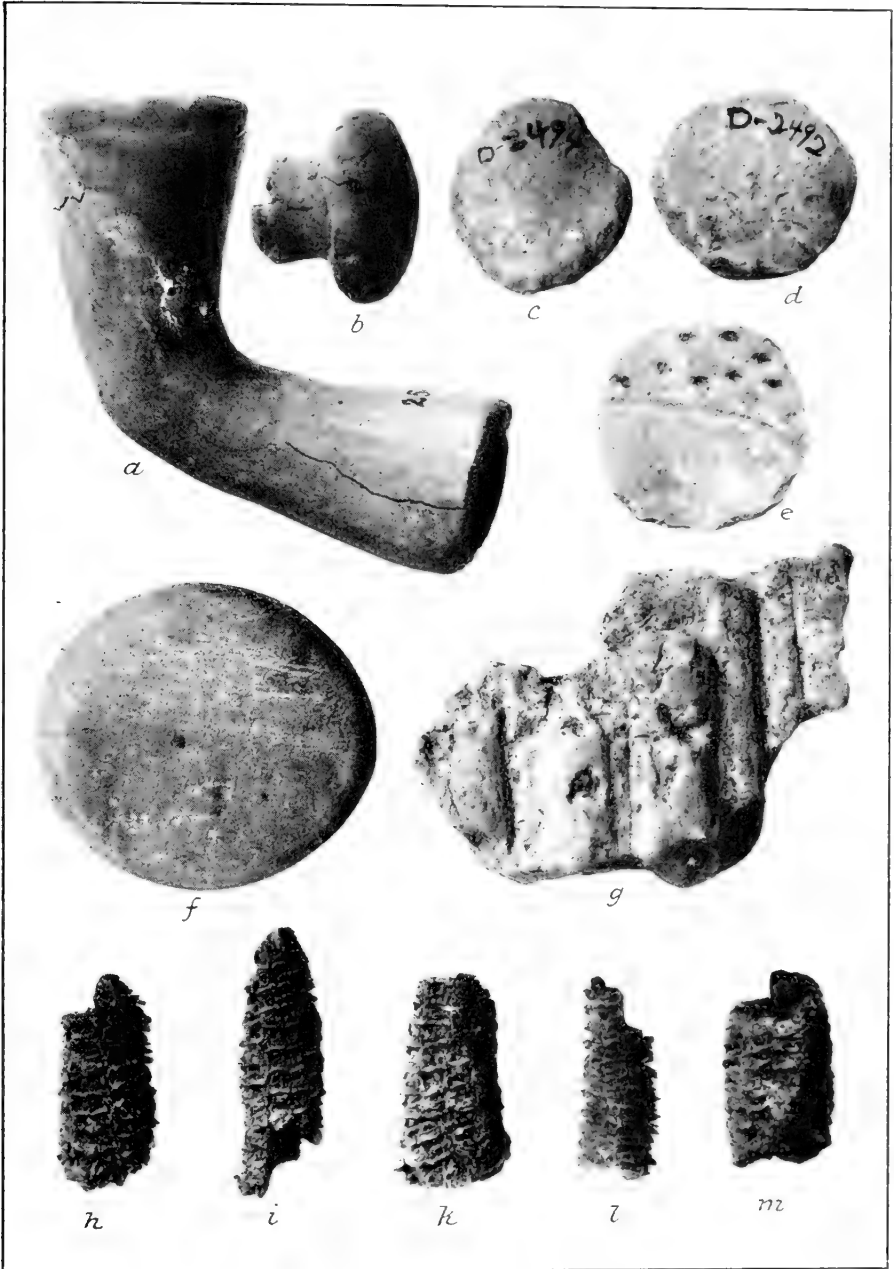




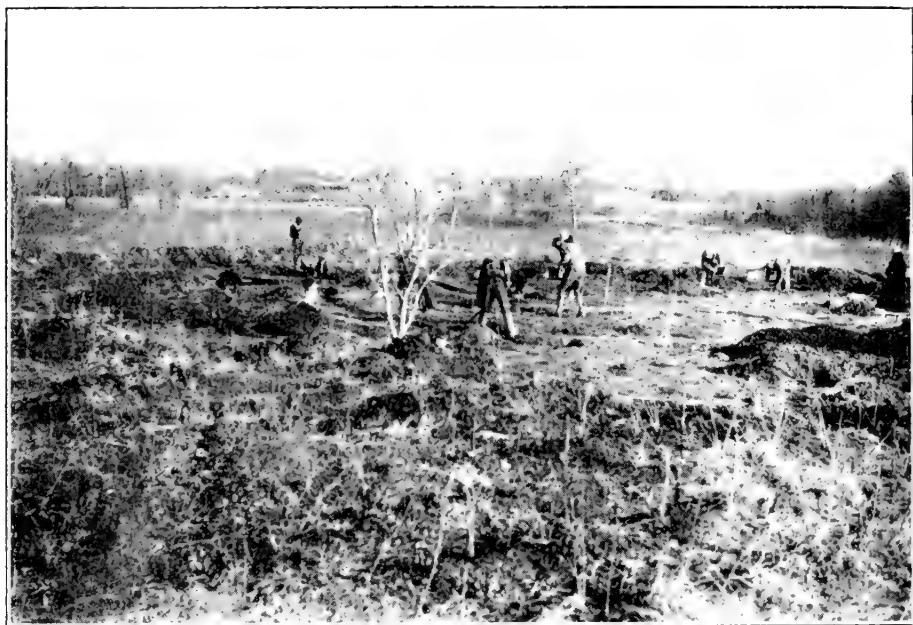
KNIVES, SCRAPERS, AND PROJECTILE POINTS OF STONE



*a-e*, HAMMERSTONES; *f*, STONE CELT OR AX



*a*, POTTERY PIPE; *b*, POTTERY OBJECT, PROBABLY FOR SMOOTHING POTTERY; *c-e*, ROUNDED POT-SHERDS FOR SMOOTHING POTTERY; *f*, STONE DISK, PROBABLY FOR SMOOTHING POTTERY; *g*, PIECE OF FIRE-BURNED WALL CLAY; *h-m*, CHARRED CORNCOBS



*a*, EXCAVATION OF HOUSE RING NO. 1



*b*, PARTIALLY EXCAVATED TRENCHES IN HOUSE RING NO. 1



*a*, ROW OF POST HOLES OF INNER SQUARE AT CENTER OF HOUSE RING NO. 1



*b*, POST HOLES AT BOTTOM OF TRENCH IN HOUSE RING NO. 2



# A NEW MIDDLE CAMBRIAN MEROSTOME CRUSTACEAN

By CHARLES ELMER RESSER

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Frank Beckwith, of Delta, Utah, recently sent to the United States National Museum for identification a photograph of a fossil collected by Emory J. John, of Clear Lake, Utah, in the banded argillaceous limestones of the Marjum formation in Weeks Canyon, House Range, Utah, stating that if the animal represented was not a trilobite, or if it was rare, he would be pleased to present it to the National Museum. Since this is the first example of a merostome from either the horizon or geographic region, it is, naturally, a rare form, and Mr. Beckwith's generous offer was accepted at once.

In order to check my interpretations, I sent photographs of this interesting fossil to Dr. Rudolf Ruedemann at Albany, N. Y., and to Gilbert O. Raasch at Madison, Wis., the only geologists known to me who are specializing in this group. It is interesting to note that their opinions agreed quite closely and fully confirmed my interpretations.

The first known Cambrian merostome was discovered many years ago in Wisconsin and described in 1863 by Hall as *Aglaspis barvandeii*.<sup>1</sup> A second species from the same general region was described by Whitfield in 1882 as *A. eatoni*.<sup>2</sup> Since that time the Upper Cambrian beds of Wisconsin have produced many of these crustaceans, descriptions of which by Raasch are about to appear. He has founded nine genera, seven of which contain one or more species based on specimens preserving the entire test. In addition to these and the eurypterid *Strabops thacheri* Beecher,<sup>3</sup> from the Upper Cambrian of Missouri, we have merostomes from Middle Cambrian beds at several places, particularly from the Burgess shale (*Molaria*, *Habelia*, *Emeraldella*, *Sidneyia*, and *Amiella*). Finally, the Lower Cambrian has furnished several forms, such as *Amiella prisca* Man-

<sup>1</sup> 16th Ann. Rep. New York State Cab. Nat. Hist., p. 181, pl. 4, figs. 7-16, 1863.

<sup>2</sup> Geology of Wisconsin, Survey of 1873-1879, vol. 4, pt. 3, p. 192, pl. 10, fig. 11, 1882.

<sup>3</sup> Amer. Journ. Sci., vol. 12, p. 364, pl. 7, 1901.

suy<sup>4</sup> from southern China and *Roddyia typa*<sup>5</sup> from southern Pennsylvania. In addition to those mentioned, scattered fragments, as yet undescribed, indicate the possible existence of still other types. The great number of Silurian eurypterid species belonging to highly varied genera indicates that their ancestry extended far back. Now that we know merostomes among the oldest recorded fossils, we are beginning to comprehend some details of this ancestry.

### BECKWITHIA, new genus

*Diagnosis*.—Merostome with a large cephalothorax having a flattened rim, ending in genal spines. Eyes rather large, possibly crescentic, situated well forward. Eight abdominal segments. Pleurae bent down at a considerable angle at the middle and also rearward, at an increasing angle from front to back. Pleural terminae bluntly truncated.

Body terminated by a spiniform telson with an extraordinarily large basal plate. The spine arises anterior to the center and apparently extended upward and backward for a distance equal to the length of pygidium.

Surface of cephalothorax strongly pustulose, remainder of body more finely granulated.

*Comparisons*.—Detailed comparisons with other merostomes are incorporated in the specific description, but the consensus of opinion among those who have seen this specimen is that it agrees most closely with *Aglaspis*.

*Genotype*.—*Beckwithia typa*, new species.

*Range*.—Middle Cambrian, Marjum formation, central Utah.

### BECKWITHIA TYPA, new species

#### PLATE 1, FIGURE 3

*Body*.—General form ovate in outline, being nearly twice as long as broad with the greatest width across the genal angles. In life the animal must have been fairly highly arched, especially transversely; at least the wrinkling of the cephalon and the shape of the thoracic segments indicate a moderate degree of compression suffered by the fossil.

*Cephalothorax*.—Semicircular, nearly twice as broad as long. The posterior margin forms a slight sigmoid curve on each side from the center of the head to the genal angles. The lateral and anterior margins, on the other hand, are regularly rounded, forming an outline that is but a little more curved than a semicircle. A flattened border runs all around and projects into short genal spines, indicating the existence of a rather wide doublure.

<sup>4</sup> Memoires du Service Géologique de l'Indochine, vol. 1, fasc. 1, p. 31, pl. 4, fig. 6, 1912.

<sup>5</sup> Resser, Proc. U. S. Nat. Mus., vol. 76, art. 9, p. 13, pl. 2, fig. 5, 1929.



The eyes are ovate or crescentic, pointed obliquely inward, situated not quite one-third the length of the cephalothorax behind the anterior margin, and separated from each other by about the same distance as they lie from the outer margin. As the eye lobes are exfoliated their original convexity and surface can not be determined.

*Abdomen.*—The dorsal side of the abdomen shows eight flat ungrooved segments. The anterior segment appears to be straight, although it is broken away on the right side and covered by the rotated cephalon on the left, so that one can not be sure of all details relating to its shape and size. Each segment back of the first increases the angularity of its outer pleural portions to the middle axial part, until in the eighth segment the lateral thirds of the pleurae are bent back at an angle of  $37^{\circ}$ . The third segment appears to be the longest and bears a short spine on the middle of the axis, near its posterior edge.

The extremities of the segments are rounded in front but sharply angular at the rear. An axis of considerable width is very faintly outlined, more by a slight flattening in the slope of the pleurae than by an actual dorsal furrow.

*Pygidium.*—The body terminates with a broad pygidial shield bearing a strong telson spine. Its frontal margin is angulated to fit the last thoracic segment, but the lateral and rear margins are curved, forming an ovate shield. The strong spine arises on the axis a little forward of the center and extends upward and backward and may have exceeded the pygidium in length. At any rate it must have projected beyond the rear margin.

*Surface.*—The cephalothorax is covered by fairly coarse pustules. These are particularly strong over what was the higher portion, diminish in size toward the posterior margin, and become much smaller on the rim. Small pustules are rather evenly distributed on the thoracic segments. The rear segments and pygidium seem to be nearly or quite smooth.

*Measurements.*—Length of animal, 57 mm.; width of cephalothorax, 37.5 mm.; length of cephalothorax, 22.4 mm.; distance of eyes apart, 14.5 mm.; length of genal spine, about 5 mm.; length of thorax, 25 mm.; length of third segment, 31 mm.; length of pygidium, 9.6 mm.; width of pygidium, 15 mm.

*Comparisons.*—Comparison must first be made with *Aglaspis eatoni*, to which *Beckwithia* is apparently most closely related, at least as far as the characters in the cephalothorax are concerned. *Beckwithia* agrees with *Aglaspis* in its pustulose test and the size of the eyes, but differs in the wider spacing of the eyes and the absence of a "glabella" or median lobe defined by a dorsal furrow.

In general the abdominal segments agree in shape and relative size, but *Beckwithia* practically or altogether lacks an axis, and has eight instead of seven segments anterior to the telson. In the telson

*Beckwithia* departs more widely from the other merostomes, since in the new form the plate from which the telson spine arises is as large as and similar to the pygidium of a large-tailed trilobite, while in *Aglaspis* the pygidial plate is relatively small and triangular. No trace of segmentation of this large telson plate is visible under a lens.

*Beckwithia* recalls *Strabops*<sup>6</sup> in the absence of longitudinal lobation, but the pustulose test, the more central position of the eyes, the presence of genal spines and, above all, the 8 instead of 12 abdominal segments, and finally the large pygidial plate instead of the spiniform telson serve to distinguish it at once.

Raasch states that the texture of *Beckwithia* resembles that of fragments occurring in the lower Eau Claire formation and suggests that, in view of the extremely early Upper Cambrian age of those remains, they might represent the new genus.

No confusion with *Sidneyia* is possible, and *Amiella* is so incompletely preserved that comparisons with it are not profitable. The absence of longitudinal trilobation serves to distinguish *Beckwithia* from all the other Burgess shale merostome genera.

*Formation and locality*.—Middle Cambrian, Marjum formation; Weeks Canyon, House Range, Utah.

*Holotype*.—U.S.N.M. No. 84170.

#### OBOLUS JOHNI, new species

##### PLATE 1, FIGURES 1, 2

Five brachiopods are attached to the dorsal surface of *Beckwithia typa* and about a dozen other, chiefly fragmentary, specimens occur in the matrix. This association is likely merely commensal. From the fact that these brachiopods efface the surface features, it would seem that they lived for a long time on this particular test, and were not merely compressed on the shell during fossilization.

*Comparison*.—This species of *Obolus* compares fairly closely with *O. mcconnelli pelias* Walcott<sup>7</sup> from the *Neolenus* zone of the Marjum formation, in Wheeler Amphitheatre, which is a few miles north of Weeks Canyon. The new species differs in its broader shape, which results in a somewhat rounder outline. It is also considerably smaller. Its posterior outline is also more circular, lacking the flattening of the described species.

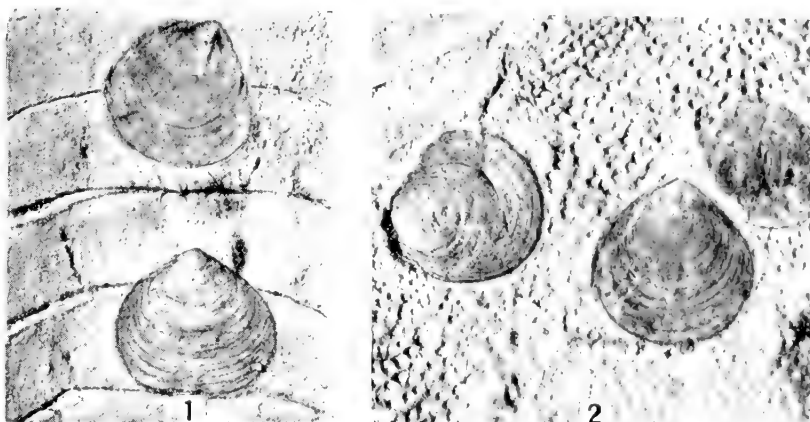
The specific name is given in recognition of the work of Emory J. John, who gives much time to collecting in the desert ranges of Utah.

*Formation and locality*.—Middle Cambrian, Marjum formation; Weeks Canyon, House Range, Utah.

*Cotypes*.—U.S.N.M. No. 84171, on *Beckwithia typa* No. 84170.

<sup>6</sup> Beecher, Amer. Journ. Sci., vol. 12, p. 364, pl. 7, 1901.

<sup>7</sup> Mon. U. S. Geol. Surv. 51, p. 398, pl. 23, figs. 3b, 3c, 1912.



## OBOLUS JOHNI AND BECKWITHIA TYPA

1, 2, *Obolus johni*, new species,  $\times 4$ , retouched figures of the five brachiopods on the test of *Beckwithia*; 3, *Beckwithia typa*, new species,  $\times 2$ , slightly retouched figure of the holotype



# FLIES OF THE GENUS PSEUDOTEPHRITIS JOHNSON (DIPTERA : ORTALIDAE)

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The present paper is the result of a survey of the ortalid flies of the genus *Pseudotephritis* in the collections of the United States Biological Survey and the United States National Museum. The opportunity is taken to present a key to the species and the varieties and to give the description of one new species, the type specimen of the latter being deposited by the Biological Survey in the National Museum collection.

There is considerable doubt as to the definite species in this genus, as there is apparently some variation in the wing markings upon which the species distinctions are based. It is possible that *P. approximata* Banks, *P. conjuncta* Johnson, and *P. metzi* Johnson may be merely varieties of one species, but only actual rearing of specimens from known parents will definitely decide this.

## Genus PSEUDOTEPHRITIS Johnson

*Pseudotephritis* JOHNSON, Ent. News, vol. 13, p. 144, 1902. (Change of name.)  
*Stictocephala* LOEW, Monographs of the Diptera of North America, pt. 3, Smithsonian Misc. Coll. 256, p. 134, 1872. (Preoccupied.)

This genus is quite similar in most respects to *Callopistromyia* Hendel, but may be readily separated from it by the wedge-shaped, instead of almost parallel-sided, prolongation of the posterior apical angle of the anal cell, and the possession of an elongate oval area on the basal third or more of the anterodorsal surface of the hind tibia, which is furnished with microscopic hairs that are erect and much finer than the decumbent hairs on the remainder of that tibia.

The larvae live under slightly loose bark of trees and occur frequently along with those of *Callopistromyia*.

Below I present a key to the species of the genus now known to me.

KEY TO THE SPECIES OF *PSEUDOTEPHRITIS*

1. Each frontal orbit with two backwardly curved bristles on the upper half; scutellum gray-dusted, with brown or blackish marks, which are never highly glossy; no small spur of a vein emanating from hind side of the fourth vein before inner cross vein (subgenus *Pseudotephritis* Johnson)----- 2.
- Each frontal orbit with but one well-developed upper bristle; scutellum gray-dusted, with a large glossy black spot on each side occupying more than the apical half; a short spur of a vein emanating from the hind side of the antepenultimate section of fourth vein and projecting into the discal cell (subgenus *Pseudotephratina*, new)----- 6.
2. Apex of the wing hyaline from tip of second to tip of fourth vein with the exception of a very small dark spot at the apex of third vein; inner cross vein with a hyaline area separating it from a dark spot on each side of it; the dark angulate mark at apex of second vein extending over disk of wing to the fourth vein----- *corticalis* (Loew).
- Apex of the wing with a brown or fuscous mark extending from, or near, apex of second vein to, or beyond, the apex of fourth; inner cross vein always inclosed in a dark mark; the dark mark at apex of second vein not extending over disk of wing to fourth vein----- 3.
3. A small round dark mark in the costal cell between the humeral dark stripe and the large preapical dark mark; the dark apical mark on wing extending into tip of marginal cell; the dark mark over the outer cross vein and the one nearer apex of second vein usually connected by a paler, yellowish shade.  

*approximata* Banks.
- No small round dark spot in the costal cell between the humeral streak and the large preapical dark mark----- 4.
4. The dark mark over the outer cross vein connected with the one near apex of second vein----- *conjuncta* Johnson.
- The dark mark over the outer cross vein sometimes connected with the one near the apex of the second vein by a yellowish cloud but never by an equally dark portion----- 5.
5. The dark mark over the outer cross vein not connected with the one on the costa before the apex of the second vein----- *metzi* Johnson.
- The dark mark over the outer cross vein connected with the one on costa before the apex of second vein by a paler, yellowish cloud, which incloses the inner cross vein----- *vau* (Say).
6. Penultimate section of fourth vein not so long as the inner cross vein; wing with two complete dark fasciae, one extending from before the apex of the auxiliary vein to the apex of sixth, the other from over the apex of first vein to the apex of fifth, the latter inclosing both cross veins----- *cribrum* (Loew).

Penultimate section of fourth vein longer than the inner cross vein; wing with one complete dark fascia, extending from near the apex of the auxiliary vein to the apex of sixth, the dark marks over apex of first vein and one outer cross vein not connected----- 7.

7. Basal pair of scutellar bristles reduced to fine hairs; the dark marks on the costa very conspicuously darker than those on the disk of the wing; visible tergites 2 to 4 of abdomen each with a dark brown apical fascia, only the fourth with faint setigerous dark spots----- *inaequalis* new species.

Basal pair of scutellar bristles as long and strong as the apical pair; dark marks on the costa not conspicuously darker than those on the disk of the wing; all the abdominal tergites with dark setigerous dots, second and third each with a pair of dark marks in center at apex----- *cribellum* (Loew).

#### Subgenus PSEUDOTEPHRITIS Johnson

It is very probable that some subsequent worker will elevate this and the other segregate of the genus to full generic rank as more trivial characters than those cited for their distinction in the key are accepted as of generic value in this family. For the present I propose to consider them as merely subgenera, more closely related to each other than either is to other genera in their immediate vicinity in the family by the possession of the peculiar, and possibly sensory, area on the hind tibia. It may be pertinent to note the occurrence of somewhat similar areas on the same tibia in the great majority of the genera in the subfamily Oscinosominae of the family Chloropidae, and of a peculiar elongate slitlike depression on the hind tibia of many males in the family Sepsidae, particularly in the genus *Themira* Robineau-Desvoidy, the latter not having been mentioned, as far as I know, in print, though there are two recent revisions of the family available.

The type species of the genus, and also of the subgenus as at present limited, is *Ortalis vau* Say. The name *Stictocephala* was preoccupied by *Stictocephala* Stal and a new name proposed by Johnson for that of Loew as above indicated.

#### PSEUDOTEPHRITIS (PSEUDOTEPHRITIS) VAU (Say)

*Ortalis vau* SAY, Journ. Acad. Nat. Sci. Philadelphia, vol. 6, p. 184, 1829.

*Stictocephala vau* LOEW, Monographs of the Diptera of North America, pt. 3, Smithsonian Misc. Coll. 256, p. 138, 1872.

*Pseudotephritis vau* JOHNSON, Ent. News, vol. 10, p. 220, 1899. (*Stictocephala*.)

I have seen this species from Texas, Virginia, Maryland, and Illinois. It has also been recorded from Ohio, New Jersey, Maine, Massachusetts, New York, and Montreal, Canada. It is probably present over the entire eastern half of the United States and northward almost as far as hardwood trees are found.

**PSEUDOTEPHRITIS (PSEUDOTEPHRITIS) APPROXIMATA (Banks)**

*Pseudotephritis approximata* BANKS, Proc. Ent. Soc. Washington, vol. 16, p. 138, 1914.

Originally described as a valid species, this form has been reduced to a variety by Johnson in several recent papers, including his list of New England Diptera, and with it is placed *metzi* Johnson as a synonym. I accept *approximata* as distinct from *vau*, and also from *metzi*, though as indicated in the introductory paragraphs it is somewhat doubtful if this is the case.

Originally described from Virginia, I have seen it from Ames, Iowa, Pennsylvania, Lafayette, Ind., and Washington, D. C. It has also been recorded from Massachusetts and New York.

**PSEUDOTEPHRITIS (PSEUDOTEPHRITIS) METZI Johnson**

*Pseudotephritis metzi* JOHNSON, Psyche, vol. 22, p. 49, 1915.

Originally described as a valid species from Massachusetts, I have seen it from White Mountains and Springfield, Mass., St. Paul, Minn., and Bilby, Alberta, Canada (Owen Bryant).

**PSEUDOTEPHRITIS (PSEUDOTEPHRITIS) CONJUNCTA Johnson**

*Pseudotephritis conjuncta* JOHNSON, Occ. Pap. Boston Soc. Nat. Hist., vol. 5, p. 15, 1915.

This species is very close to *approximata* if not actually a variety of it, the only distinctions between it and *metzi* and *approximata* that I can find being those cited in the foregoing key to the species. Some specimens of *metzi* in the National Museum and one of *approximata* have the fascia over the outer cross vein almost as complete as in the present form.

Originally described from Maine, and there is but one specimen identified by Dr. J. M. Aldrich as this in the National Museum, and that from the same State.

**PSEUDOTEPHRITIS (PSEUDOTEPHRITIS) CORTICALIS (Loew)**

*Stictocephala corticalis* LOEW, Monographs of the Diptera of North America, pt. 3, Smithsonian Misc. Coll. 256, p. 136, 1872.

This species is readily distinguished from its congeners by the characters cited in the foregoing key to the species.

Originally described from New York State. Subsequently recorded from Connecticut. I have seen a series in the National Museum reared from larvae found under the bark of a tuliptree, Dead Run, Va., April, 1913 (R. C. Shannon), and single specimens taken at Washington, D. C., May 13, 1911 (W. L. McAtee), and Bilby, Alberta, Canada, May 13, 1925 (Owen Bryant).



## PSEUDOTEPHRITINA, new subgenus

The anterior fronto-orbital bristle is very rarely present as a very short setula but never as a well-developed bristle; the specimens available to me all have a quite distinct spur vein projecting from the posterior side of the fourth vein into the discal cell, and the scutellum is more swollen than in the other subgenus and has two large glossy black spots. The legs are much paler than in the other group, but this is not considered as diagnostic.

Type species of subgenus, *Stictocephala cribellum* Loew.

## PSEUDOTEPHRITIS (PSEUDOTEPHRITINA) INAEQUALIS, new species

*Female*.—Head testaceous, densely pale gray-dusted, upper occiput fuscous, frons with numerous oval piliferous reddish dots, no black spot behind ocelli, and the postocular cilia hardly darkened around bases; antennae and palpi testaceous yellow. Thorax fuscous, densely gray-dusted, mesonotum and pleura with many dark-brown piliferous punctures, a large black mark covering postalar region on which there is a group of black setulose hairs; scutellum gray-dusted, with a large glossy black mark on each side at apex. Abdomen fuscous, yellowish at base, densely gray-dusted, tergites 2 to 4 each with an apical dark brown fascia, the fourth with some small piliferous dots, genital segment testaceous yellow, black on sides and along center below, the hairs dark. Legs testaceous. Wings as in *cribellum* Loew, but the costal marks preceding apices of auxiliary, first, and second veins conspicuously darker than those on the disk of the wing.

Structurally similar to *cribellum*, the scutellum thick, with a slight central apical depression. Postalar region quite copiously setulose. Outer cross vein about one-fifth from apex of discal cell.

Length, 7 mm.

*Type*.—U.S.N.M. No. 43457. Collected at De Beque, Colo., July 20, 1922, by E. R. Kalmach.

## PSEUDOTEPHRITIS (PSEUDOTEPHRITINA) CRIBELLUM (Loew)

*Stictocephala cribellum* LOEW, Monographs of the Diptera of North America, pt. 3, Smithsonian Misc. Coll. 256, p. 134, 1872.

Originally described from Nebraska. Recorded subsequently from Minnesota and Quebec, Canada. I have seen specimens from Hot Springs, Ariz., New Mexico, Montana, Indiana, Virginia, and District of Columbia.

## PSEUDOTEPHRITIS (PSEUDOTEPHRITINA) CRIBRUM (Loew)

When Loew described this species he had some doubts as to its specific distinction from *cribellum*, and he indicated that it might be merely a variant, in which case the latter name would have priority.

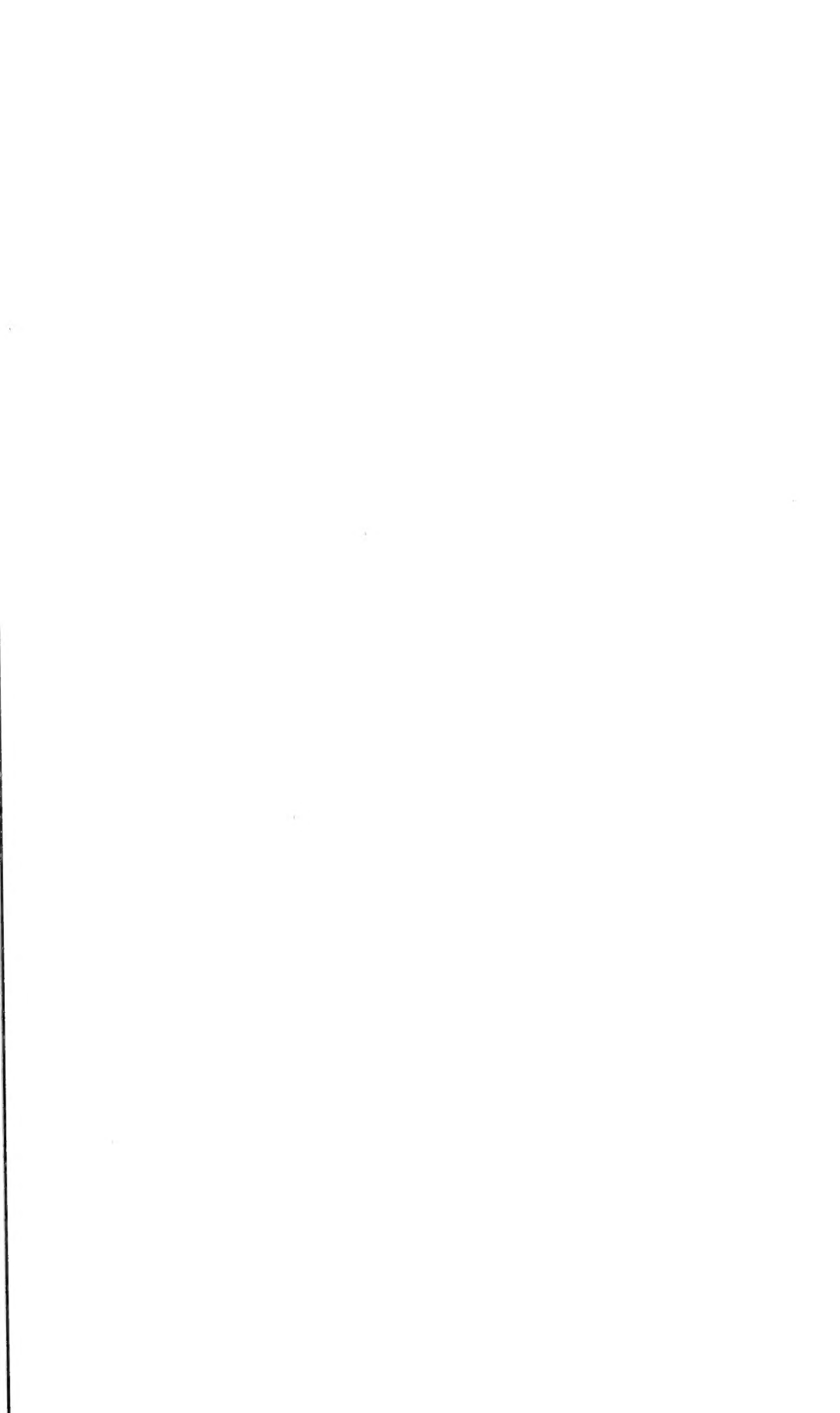
There is one specimen in the National Museum that has the characters cited in the foregoing key and in addition has the basal pair of scutellar bristles very much smaller and finer than the apical pair; and two specimens that have the same wing characters as cited and the four scutellar bristles about equally long and strong.

Though it may be proved yet that this is merely a variety of *cribellum*, in the meantime the evidence at hand convinces me that it is best to retain them as distinct species until rearing from known parents proves to the contrary.

Originally described from the "Middle States." Subsequently recorded from New York. Specimens in National Museum are from Onaga, Kans., Victoria, Tex., and Redlands, Calif.











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